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January 8, 2019

Ms. Ann Seiler
Office of Site Certification
Division of Air Resources Management
Florida Department of Environmental Protection
2600 Blair Stone Road, MS 5500
Tallahassee, Florida 32399-2400

Re: Hopkins RICE Project
Site Certification Modification Application
Arvah B. Hopkins Generating Station (Facility ID 0730003)

Dear Ms. Seiler:

The City of Tallahassee submits the attached Site Certification Modification application for the addition of a Wärtsilä 18.82 megawatt (MW) spark-ignition gas-fired electric generator at the City of Tallahassee's Arvah B. Hopkins (Hopkins) Plant. This unit would be the fifth such unit as the City is currently installing four Wärtsilä Model 18V50SG four-cycle spark-ignition engines (also referred to as fueled reciprocating internal combustion engines—RICE) fired with natural gas and connected to associated electric generators. The proposed Project does not propose any steam generating capability addition to the Hopkins Site and is therefore being submitted as a Petition for Modification.

The Hopkins Site has been certified under Florida's Power Plant Siting Act [PPSA; 403.501-.519, F.S.] (PA 74-030). The certification includes Unit 2A, HC3 and HC4 as well as associated facilities. Units 1, CT-1, and CT-2 pre-date the PPSA and, therefore, are not certified and have been recently retired. Since the Hopkins Site is certified, a petition for modification pursuant to 403.516, F.S., 62-17.211(1)(b)(1), F.A.C. and Condition A.XXIII of the Conditions of Certification is being submitted to the Florida Department of Environmental Protection (FDEP) for the Project.

If you have any questions regarding the information above, please do not hesitate to contact me at (850) 891-8710, or Alissa Meyers, Environmental Regulatory Compliance Administrator at (850) 891-8851 or Henry Gainer, Assistant General Manager – Energy Supply at (850) 891-5034.

Sincerely,

Russell Wider, P.E.
Environmental Engineer

Attachment

cc: Triveni Singh, COT
Alissa Meyers, COT
Henry Gainer, COT
Leigh Ann Taranto, COT
Pat Faircloth, COT



Site Certification Petition for Modification

City of Tallahassee

Arvah B. Hopkins Power Plant

Submitted to:

Siting Coordination Office (SCO)

2600 Blair Stone Road, MS 5500

Tallahassee, FL 32399-2400

Submitted by:

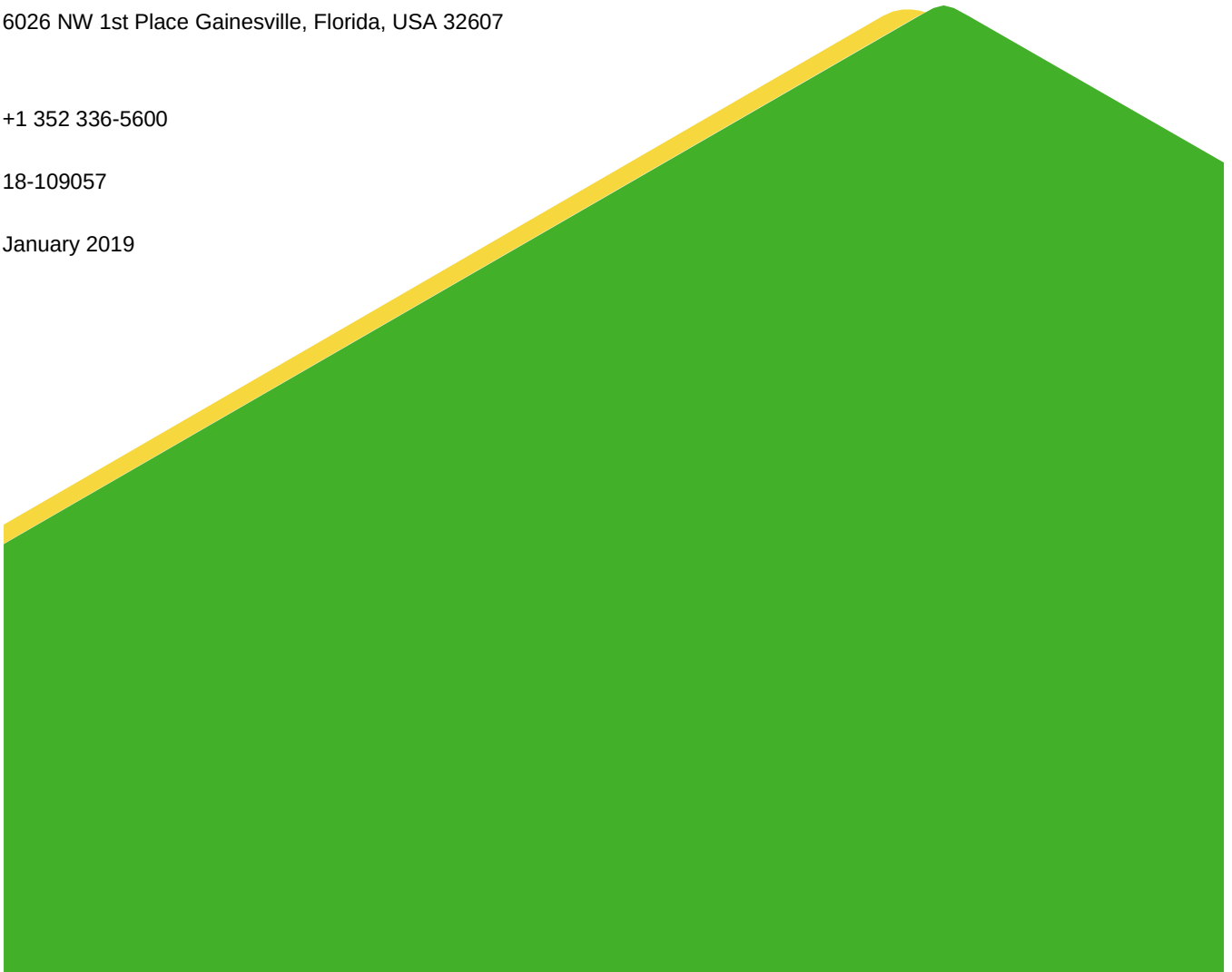
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18-109057

January 2019



Executive Summary

The City of Tallahassee owns and operates the Arvah B. Hopkins Generating Station (“Hopkins”). Four 18.82 megawatt (MW) natural gas fired generating units are currently being constructed and nearing completion at Hopkins. The City of Tallahassee proposes to add one Wartsila 18.82 megawatt (MW) spark-ignition gas-fired electric generator (the “Project”) to compliment the four Wartsila generators being installed.

Hopkins Unit 2 was certified under Florida’s Power Plant Siting Act (PPSA), Chapter 403, Part II, Florida Statutes (F.S.), and the proposed Project will be located on an existing portion of the Certified Site. The four Wartsila generators were included as a modification to the Site Certification and included in the Conditions of Certification (PA 74-03P). Condition A.XXIII requires that any anticipated facility expansion be obtained through an amendment, modification or certification. This document is submitted to the Florida Department of Environmental Protection (FDEP) pursuant to 403.516 F.S. and 62-17.211, Florida Administrative Code (F.A.C.) to include the additional Wartsila generator at Hopkins. The proposed Project does not propose any steam generating capability addition to the Hopkins Site and is therefore being submitted as a Petition for Modification.

In accordance with Section 403.516(c)(1), F.S. and Rule 62-17.211(1)(b), F.A.C., this Petition for Modification describes the reason for the modification, changes to the Site layout, and anticipated environmental impacts of the Project. No changes in the existing Conditions of Certification are necessary as a result of the Project.

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1.0 INTRODUCTION

1.1 City of Tallahassee - Electric Utility – Background and Generation Needs

The City of Tallahassee (“City”) owns, operates, and maintains an electric generation, transmission, and distribution system that supplies electric power in and around the corporate limits of the City. The City's Electric Utility presently serves approximately 120,000 customers located within a 221 square mile service territory. The Electric Utility operates three generating stations with a total summer season net generating capacity of 700 megawatts (MW).

The City has two fossil-fueled generating stations, which contain combined cycle (CC) units consisting of combustion turbines (CTs) and associated steam turbines as well as simple cycle CTs. The Sam O. Purdom Generating Station, located in the City of St. Marks, Florida has been in operation since 1952; and the Arvah B. Hopkins Generating Station (“Hopkins”), located on Geddie Road west of the City, has been in commercial operation since 1970. The City executed a Power Purchase Agreement for 20 MW of photoelectric solar energy with Origis Energy USA. This facility is located adjacent to the Tallahassee International Airport and began commercial operation in December 2017.

To meet generation needs, including consideration of existing resources reaching the end of their useful life, the City is constructing four 18.82 MW natural gas fired generating units at Hopkins located in Leon County, Florida (see Figure 1-1 for the general location of the Project). The four units are Wartsila Model 18V50SG four-cycle spark-ignition engines (also referred to as reciprocating internal combustion engines – RICE) fired with natural gas and connected to associated electric generators. These four generators were included as part of the Certification for the Hopkins Plant via a modification in 2017 (PA 74-03P; Dated 8/8/17). The construction of the four Wartsila generating units is nearly complete. The four Wartsila generators replaced two existing early 1970s vintage combustion turbines with a net summer rating of 12 MW and 24 MW, respectively, as well as Unit 1, an existing 76 MW steam electric generating unit. The retired units represent 112 MW of generating capacity.

The City, as identified in the 2018-2027 Ten-Year Site Plan submitted to the Florida Public Service Commission, proposes to install a fifth Wartsila generator to meet future generation needs. Since the Hopkins Site is certified, a petition for modification pursuant to 403.516, F.S., 62-17.211(1)(b)(1), Florida Administrative Code (F.A.C.) and Condition A.XXIII of the Conditions of Certification is being submitted to the Florida Department of Environmental Protection (FDEP) for the Project.

To obtain a modification, the requirements of 403.516(1)(c), F.S. and 62-17.211(1)(b)(1), F.A.C., must be met. For convenience, the requirements are listed below.

- The licensee may file a petition for modification with the FDEP, or the FDEP may initiate the modification upon its own initiative.
 - A petition for modification requested by the applicant must set forth:
 - The proposed modification
 - The factual reasons asserted for the modification, including the changes of circumstance which justify the modification

- A statement of whether, and if so, how the proposed modification would affect the conditions of certification, the site layout or the design as depicted in the current application
- The anticipated environmental effects of the proposed modification

This Petition for Modification describes the reason for the modification, changes to the Site layout, and anticipated environmental impacts of the Project. No changes or additions to the Conditions of Certification are necessary as a result of the Project. As a result, this SCA modification application addresses only those environmental aspects that will be changed by the Project.

1.2 Arvah B. Hopkins Power Plant

The Hopkins Site is located approximately 7 miles west of the center of the City of Tallahassee in Leon County, Florida. The Universal Transverse Mercator (UTM) coordinates for the center of the Site are 749.4 km east and 3371.7 km north. The Site is in Section 25 and 26, Township 1 North, Range 2 West. The western boundary of the Hopkins Site is Geddies Road (County Road 1585), and part of the eastern boundary is the CSX railroad. South of the Site is State Road 20 and north of the Site is U.S. Highway (U.S.) 90.

The Hopkins Generating Station is presently comprised of one steam electric generating units (Unit 2A), two General Electric (GE) LM6000 combustion turbines (referred to as HC-3 and HC-4), and the four 18.82 MW natural gas-fired Wartsila Model 18V50SG RICE currently nearing construction completion. HC-3 and HC-4 began operation in 2005. Unit 2 was originally certified in 1975, and was re-powered as a GE 7FA combined cycle combustion turbine via a modification in 2006 (startup in 2008), now referred to as Unit 2A. HC-3 and HC-4, the four Wartsila generators currently nearing construction completion, and Unit 2A are all certified under PPSA (PA74-03P).

1.3 Project Overview

The Project will consist of one Wartsila Model 18V50SG natural gas fired generator that produce 18.82 MW at 100 percent load and complements the four Wartsila generators nearing completion of construction. The Project will not require an increase in current water allocations or changes to the on-Site stormwater management system. The increase in noise levels associated with the Project is expected to be 0.1 dBA or less. A separate Air Construction/PSD Permit Application for the Project is included as Appendix A to this Petition for Modification and is submitted separately to the FDEP Division of Air Resource Management.

2.0 PROJECT DESCRIPTION

2.1 Project Layout

The Project layout is shown in Figure 2-1. The fifth Wartsila generator will be located directly east of the four Wartsila generators nearing construction completion within an expanded engine hall building. An additional cooling radiator will be located east of the fifth unit's stack and SCR system.

2.2 Fuel

The fuel used in the engine will be natural gas. The generating capacity of a Wartsila W18V50SG generator is not as significantly affected by ambient temperature as a gas turbine but has slightly reduced efficiency at higher ambient temperatures. Therefore, for the purpose of calculating fuel use quantities an ambient temperature of 104 degrees Fahrenheit (°F) was used. The maximum heat input for the engine is 145.4 million British thermal

units per hour (MMBtu/hr), low heating value (LHV) [161.4 MMBtu/hr, high heating value (HHV)], when firing natural gas [100 percent capacity, 104 degrees °F]. The corresponding maximum fuel usage is about 0.153 million cubic feet per hour (MMcf/hr) of natural gas. Maximum potential fuel usage is about 1.34×10^9 cubic feet per year (cf/yr) of natural gas for the Project operating 8,760 hr/yr at maximum heat input and load.

Natural gas will be transported to the facility via existing pipeline. No onsite storage will be provided for natural gas.

2.3 Air Emissions and Controls

The Wartsila Model 18V50SG engine is a lean-burn engine with pre-chamber mixing and low peak combustion temperatures to reduce formation of nitrogen oxides (NO_x) while insuring proper combustion to minimize the emissions of carbon monoxide (CO) and volatile organic compounds (VOCs). The Wartsila Engine Control System (WECS) is designed to control each cylinder to insure optimal control and operation. The fifth engine will also be equipped with selective catalytic reduction (SCR) to control NO_x emissions to 5 parts per million volume-dry (ppmvd) corrected to 15 percent O₂ and an oxidation catalyst to control CO emissions to 15 ppmvd corrected to 15 percent O₂.

The fifth Wartsila engine will be required to comply with U.S. Environmental Protection Agency's (EPA's) New Source Performance Standards (NSPS) for spark-ignition internal combustion engines in 40 Code of Federal Regulations (CFR) Part JJJJ and EPA's National Emission Standards for Hazardous Air Pollutants (NESHAPS) for reciprocating internal combustion engines in 40 CFR Part 63 Subpart ZZZZ. The use of the SCR and oxidation catalyst will reduce emissions of NO₂, CO, VOC and formaldehyde to levels well below the federally mandated emission limits in these regulations.

The Project, which involves a generator that is identical to four other engines currently nearing construction completion at the site as part of a previously permitted project, will be required to undergo review pursuant to FDEP's Prevention of Significant Deterioration (PSD) requirements that include a determination of Best Available Control Technology (BACT). PSD review is required for several air pollutants: volatile organic compounds (VOCs), particulate matter (PM), PM₁₀ with an aerodynamic diameter of 10 microns or less (PM₁₀), PM_{2.5} with an aerodynamic diameter of 2.5 microns or less (PM_{2.5}), and greenhouse gases (GHGs). The use of clean fuel (i.e., natural gas), combustion technology, oxidation catalyst and efficiency of the Wartsila engine are proposed as BACT for the Project. In addition, the use of SCR reduces emissions to levels considered as BACT on many similar projects.

The Air Construction/PSD Permit Application for the Project provides detailed information on air emissions and control technology proposed for the Project. This document is attached as Appendix A to this Petition for Modification and is submitted separately to the FDEP Division of Air Resource Management.

2.4 Plant Water Use

The operation of the additional Wartsila engine does not require continued water use, as a closed-cycle radiator is used for cooling. The amount of water to replenish the closed-cycle cooling system is about 1 gallon/week. A new radiator will be installed east of the fifth unit's stack and SCR system. General service water uses will include cleaning, flushing and fire protection, and will be provided by the existing process/service water system.

The use of potable water will not increase as a result of the Project as no additional staff is required. Some minor amounts of potable water will be used during construction and supplied by existing systems or bottled water. Portable sanitary systems will be used during construction as necessary.

2.5 Chemical and Biocide Waste

There are minimal chemical wastes associated with the operation of the Project. The cooling system is a closed-cycle radiator and does not require the use of biocides.

2.6 Solid and Hazardous Waste

Construction contractors will be required to implement Best Management Practices (BMPs) to minimize spills. Maintenance and refueling will be performed only in designated areas. Any spills will be cleaned up, and wastes will be disposed of in accordance with applicable requirements.

Solid wastes will be generated by the operation of the Project, but generally in very small quantities. Such solid wastes will be limited to small amount of municipal solid waste (MSW), infrequent replacement of inlet air filters, and operations and maintenance wastes. Oil filters will be recycled or disposed as an oily waste. Approved disposal contractors will dispose of all wastes.

The City will operate the Project to minimize, if not eliminate, the generation of hazardous waste. Hazardous wastes, if any, will be collected onsite and disposed of by a licensed hazardous waste contractor. Hazardous waste will be managed according to applicable rules and regulations as is the current practice at the Hopkins Plant.

Solid waste materials generated during Project construction will be disposed of in accordance with applicable rules and regulations. Construction and dismantlement wastes, such as scrap metal, will be transferred to a specified storage area on the Site where they will be separated and stockpiled for salvage and recycling. General waste materials (i.e., typical of MSW) will be collected in appropriate waste collection containers for disposal at an approved offsite location.

All solid and hazardous waste generated will be handled in accordance with Condition of Certification A.XXX.III.

2.7 Onsite Drainage System

Operational site stormwater runoff that is from non-contact stormwater areas (non-oil/water sources) from adding an additional Wartsila generator will be handled by the stormwater management system that was approved for the four Wartsila generators nearing construction completion. An existing stormwater system for the Hopkins Plant was modified to accommodate the four Wartsila generators and its design included the potential addition of a fifth Wartsila generator in the engine building. The design details were presented in Appendix B of the Site Certification Petition of Modification, April 2017, Golder Associates Inc. While the original plan evaluated the construction of five generators, only four were constructed. An updated stormwater analysis was performed to evaluate the “as built” stormwater system to accommodate the fifth Wartsila generator that includes a 2,500 square foot concrete pad for the radiator (see Appendix B). The updated stormwater analysis determined the stormwater system as constructed for the four Wartsila generators provides adequate attenuation and conveyance to meet the requirements of Leon County Land Development Code and the Northwest Florida Water Management District for the addition of the fifth generator. No additional modifications to the stormwater management system are required.

The existing upgraded stormwater management system provides the required water quality treatment, attenuation, and stage storage through the dry detention pond located on the site. The treated stormwater is released via the existing discharge structure at not erodible discharge rates.

Contact stormwater oil/water sources is routed to an oil/water separator via an oil/water waste piping system. Secondary containment is provided at the source of large oil storage volumes (large transformers and oil storage tanks). Curb barriers and drains is used at smaller oil/water sources. All oil/water separator effluent is routed to the City's sewer system.

The construction to accommodate the fifth Wartsila generator will be under FDEP's Generic Permit for Stormwater Discharge from Large and Small Construction Activities [FDEP Rule 62-621.300(4)(a), F.A.C.] and existing Conditions of Certification A.V.B., A.XXVII.B., and B.V.B. The Notice of Intent (NOI) will be submitted to FDEP at least two days prior to commencement of construction. Prior to submitting the NOI for the construction permit, a comprehensive Stormwater Pollution Prevention Plan (SWPPP) will be prepared, as required under the Generic Permit, addressing the construction of the Project.

During construction, stormwater will be managed by the existing stormwater management system. Stormwater discharges will be controlled to meet the requirements of the Generic Permit for Construction, Conditions A.V.B. and B.I.D. and appropriate pollution prevention techniques will be implemented to minimize erosion and sedimentation and properly manage stormwater.

2.8 Project Construction, Heavy Equipment and Materials

The construction laydown and parking areas will be located in the same areas as the four Wartsila nearing construction completion. These areas were located north and west of Unit 2A. The Site has been occupied by an operating power generation facility for more than 45 years. The areas to be used for Project construction, including the construction parking and laydown areas have been previously impacted. The soils are generally suitable for the development of the Project, obviating the need for substantial filling. Unsuitable soils will be removed and fill added, as necessary. The construction parking and laydown area may be stabilized with rock, limestone, and shell. Other more lightly used areas may be seeded or sodded with grass to prevent erosion.

Access to the Site including the construction parking and laydown areas is Geddie Road. Geddie Road is connected to U.S. 90 to the north of the Site and State Road (SR) 20 south of the Site.

Construction materials and equipment will be delivered to the Hopkins Plant, including the construction parking and laydown areas, by existing roadways. Equipment and component parts of the Project will be unloaded and moved using portable cranes and trucks. Some of the heaviest items, such as the Wartsila generating set (about 400 tons), may require special transport. Equipment that cannot be transported to the area by highway may be transported to the site by rail. All transport will comply with applicable Florida Department of Transportation requirements, including those related to overweight and over-dimensional loads in Chapter 316, F.S., and Chapter 14-26, F.A.C.

The construction workforce for the Project is expected to be 100 or less workers at the peak of construction activities. Construction of the Project is expected to take approximately 12 months or less, beginning in the first half of 2019 and concluding in early 2020.

Fugitive dust generation from construction traffic will be minimized through the use of existing paved roads and the use of water sprinkling or other dust-suppressant techniques.

3.0 ENVIRONMENTAL CHARACTERIZATION AND IMPACTS

3.1 Land Use and Zoning

During the original 1974-75 certification proceeding for Hopkins Unit 2, the Site was determined to be consistent with the land use plans and zoning ordinances of Leon County, Florida. The Project will be constructed wholly within the Site previously determined consistent with the County's land use plans and zoning ordinances.

While the Site has already been deemed consistent, we also provide the following as to land use and zoning consistency. The Hopkins Site is currently designated Governmental Operations on the Future Land Use Map. This land use designation expressly allow "Electric Generating Facilities." Leon County Comprehensive Plan, Future Land Use Element, Policy 2.2.1.6.

The current zoning under the Leon County Code is Light Industrial (M-1). M-1 districts are designated suburban and urban areas that have convenient access to transportation facilities, where facilities and activities, including "community" facilities that are compatible with light industrial operations are permitted. Sec. 10-6.6.52, Leon County Code. Permitted principal uses include "utilities" and "heavy infrastructure". Heavy Infrastructure – as defined in the Comprehensive Plan Glossary– falls under the category of a "Community Facility" and includes uses such as Electric Generating Facilities.

3.2 Air Impacts

The Project is required to be reviewed under FDEP's PSD requirements that include determination of compliance with National Ambient Air Quality Standards (NAAQS) and PSD Class I and II Increments for PM₁₀ and PM_{2.5}. Air modeling using EPA- and FDEP-approved dispersion models and meteorological data demonstrated that the Project would fully comply with the applicable NAAQS and allowable PSD Class I and Class II Increments. The Air Construction/PSD Permit Application for the Project provides detailed information on air quality impacts for the Project. This document is attached to this Petition for Modification as a referenced document and is submitted separately to the FDEP Division of Air Resources Management.

3.3 Noise

3.3.1 Background

Sound propagation involves three principal components: a noise source, a person or a group of people, and the transmission path. While two of these components, the noise source and the transmission path, are easily quantified (i.e., by direct measurements or through predictive calculations), the effect of noise on humans is the most difficult to determine due to the varying responses of humans to the same or similar noise patterns. The perception of sound (noise) by humans is very subjective, and just as for odors and taste, it is very difficult to predict a response from any particular individual to these levels.

Noise above certain levels can impact the health and welfare of plant employees, the general public and wildlife. The magnitude of noise levels or loudness is referred to as sound pressure level (SPL), with units in decibels (dB). Decibels are calculated as a logarithmic function of SPL in air to a reference effective pressure, which is considered the hearing threshold, or:

$$\text{SPL} = 20 \log_{10} (P_e/P_o)$$

where: P_e =measured effective pressure of sound wave in micropascals (μPa), and

P_o =reference effective pressure of 20 μPa .

To account for the effect of how the human ear perceives sound pressure, at moderate to low levels, SPLs are adjusted for frequency (or pitch). One of the most commonly used frequency filters is the A-weighting (dBA), which adjusts measurements for the approximated response of the human ear to low frequency SPLs [i.e., below 1,000 hertz (Hz)] and high frequency SPLs (i.e., above 10,000 Hz).

The measured noise levels are typically expressed as percentiles of occurrence (L_n), where n is a user-selected value and expressed as:

- L_{eq} - The sound pressure level averaged over the measurement period; this parameter is the continuous steady sound pressure level that would have the same total acoustic energy as the real fluctuating noise over the same time period
- L_{max} - The maximum sound pressure level for the sampling period
- L_{min} - The minimum sound pressure level for the sampling period
- L_n - The sound pressure levels which were exceeded n percent of the time during the sampling period ranging from 0.01 to 99.99. The percentiles of occurrences typically are L_5 , L_{10} , L_{50} , L_{90} and L_{95} , which correspond to SPLs that are exceeded 5%, 10%, 50%, 90% and 95% of the time. For example, L_{90} is the level exceeded 90 percent of the time.

Noise has two different types of effects on people: the direct physical effects such as hearing loss and the less direct effects involving interference with activities such as sleep and conversation. In the early 1970s, the EPA established numerical noise standards. The noise standards were developed without considering cost or technical feasibility. In developing these standards, the EPA drew upon a large body of survey data describing the degree of activity interference and resulting annoyance for a variety of noise levels. However, these standards were never implemented by EPA.

3.3.2 Noise Standards

There are no Florida or federal noise regulations applicable to the Project. There are no applicable local noise standards to the Project. The City of Tallahassee has a noise ordinance that establishes noise limits within the Urban Core District and receiving properties outside the Urban Core District. (Chapter 12-92 through 12-97, Division 2-Excessive Noise, Article IV-Offenses Involving Public Peace and Order, City of Tallahassee Code of Ordinances; Ordinance No. 15-O-37AA, § 2, 1-27-2016). This noise ordinance does not apply to Hopkins facility pursuant to Section 12-95 (g). Leon County has a qualitative noise ordinance, but this ordinance does not apply within the City of Tallahassee boundaries (Chapter 12, Article II, Section 12-53, Leon County Code of Ordinances).

3.3.3 Background Noise Levels

Ambient noise levels were obtained at three separate periods associated with the new and existing generating units at the Hopkins Power Plant. A baseline noise survey was conducted in 2004 for the SCA modification associated with new combustion turbines (HC-3 and HC-4). In 2006, additional noise monitoring was conducted for the SCA Modification of Hopkins Unit 2 Repowering Project. Noise measurements were also taken in 2008 to determine noise levels with repowered Hopkins Unit 2A operating. These ambient noise measurements and the background noise levels selected for the impact analysis are summarized in the following sections.

3.3.3.1 2004 Noise Monitoring

On March 29 and 30, 2004 Golder performed a background noise survey to assess the existing ambient noise levels in the vicinity of the Hopkins Plant. The SPLs and octave band data were collected at four distinct locations to delineate the existing background noise levels at or near the north, south, east, and west perimeters of the facility. Type I integrating sound level meters were used that were calibrated according against National Institute of Standards and Testing (NIST) standards. The equipment used to monitor the baseline noise levels operated in the slow response mode to obtain accurate, integrated, A-weighted sound pressure levels. A windscreen was used because all measurements were taken outdoors. The microphone was positioned so that a random incidence response, as specified by the American National Standard Institute (ANSI), was achieved. The sound level meter and octave band analyzer were calibrated immediately prior to and just after the sampling period to provide a quality control check of the sound level meter's operation during monitoring.

During the noise survey, Hopkins Unit 1 was not operating, but Unit 2 was fully operational. The combustion turbines were operated for two consecutive hours during the daytime and two consecutive hours during the nighttime. Each monitoring location had an individual sound level meter to simultaneously collect and record background noise levels. Noise monitoring was continuously performed at the four monitoring locations so that the daytime (7 a.m. to 10 p.m.) and nighttime (10 p.m. to 7:00 a.m.) hours were measured. Monitoring was conducted using the sound level meter mounted on a stanchion at a height of 1.2-m (4-ft) above grade. Local meteorological conditions (wind speed, wind direction, temperature, and relative humidity) were measured during the monitoring periods. The operator recorded detailed field notes during monitoring and included major noise sources in the area.

A summary of the results are presented in Table 3-1.

3.3.3.2 2006 Noise Monitoring

A noise monitoring program was conducted on February 7 and 8, 2006 at four monitoring stations at the boundaries of the Hopkins Power Plant. Unit 2 was operating during the monitoring with intermittent operation of Unit 1 and CT1 through CT4. The methods and locations were similar to those performed in 2004 with the exception that specific daytime and nighttime noise measurements were taken at each location. Two daytime measurements and one nighttime measurements were obtained. The results of the noise monitoring is presented in Table 3-2.

3.3.3.3 2008 Noise Monitoring

Noise monitoring was conducted in August 2008 that included three on-site locations inside the station's fence line. Unit 2A was operating during the monitoring with intermittent operation of CT1 through CT4. Data were collected at these locations on August 11, 12, 18, and 19, 2008 during different operational conditions. The noise monitoring methods were similar to those used in 2004 and 2006. Since this monitoring was to specifically identify operational noise, two locations were within the plant boundary and one monitoring location was near the boundary. The results of this monitoring is presented in Table 3-3. Monitoring location identified as Monitoring Location 2 was in a similar location as Monitoring Location 3 from the 2004 and 2006 studies.

3.3.3.4 Summary of Noise Monitoring

Table 3-4 presents a summary of the sound levels taken in 2004 and 2006. This table also presents the sound levels taken in 2008 for the monitoring location most representative of the Monitoring Location 3 location. The highest L_{90} background noise levels were used in the analysis. The L_{90} is the sound level that is exceeded

90 percent of the time and excludes the majority of the transient noise sources, such as motor vehicles and aircraft. In contrast, the equivalent continuous sound level (L_{eq}) or the average sound pressure level, represents all the noise observed over the sampling period. There are a number of transient sources that occur with any the background monitoring such as motor vehicles, aircraft, barking dogs, and birds. As a result, the L_{90} is a representative background for predicting the contribution of the Project to overall noise levels in the vicinity of the plant and is representative of the overall noise levels from operating noise source. The L_{90} sound levels used in the impact analysis were:

- Monitoring Location 1. Hopkins Plant Boundary - South of Generating Units – 50 dBA
- Monitoring Location 2. Hopkins Plant Boundary - Geddie Road Northwest of Generating Unit – 54 dBA
- Monitoring Location 3. Hopkins Plant Boundary - Railroad Track Northeast of Generating Units – 55 dBA
- Monitoring Location 4. Hopkins Plant Boundary - Transmission Corridor Southeast of Generating Units – 46 dBA

These background noise levels are considered conservative since they represent the highest measurements observed during the monitoring periods including periods where Unit 2A and, HC-3 and HC-4 were operating.

3.3.4 Noise Impacts

3.3.4.1 Methodology

The methodology for determining the potential noise impacts for the operation of the Project were developed using the CadnaA computer model, a computerized software program for calculation, presentation, assessment and prediction of environmental noise (DataKustik, 2008).

CadnaA is an environmental noise propagation computer program that was developed to assist with noise propagation calculations for major noise sources and projects. Noise sources are entered as octave band sound power levels (L_w). Locations of the noise sources, structures, and receptors are input directly on the base map and can be edited throughout the modeling process. All noise sources are assumed to be a point, line, area, or vertical area source, and can be specified by the user. Sound propagation is calculated by accounting for hemispherical spreading and three other user identified attenuation options: atmospheric attenuation, path specific attenuation, and barrier attenuation. Atmospheric attenuation is calculated using International Organization for Standardization, ISO 9613-1 *Attenuation of Sound During Propagation Outdoors - Part 1: Calculation of the Absorption of Sound by the Atmosphere*. The CadnaA path-specific attenuation can be specified to account for the effects of soil, vegetation, foliage, and wind shadow. Directional source characteristics and reflection can be simulated using path-specific attenuation. Barrier attenuation is calculated by assuming an infinitely long barrier perpendicular to the source-receptor path. Total and A-weighted SPLs are calculated.

The noise impacts for operation were evaluated using the sound power levels for the various types of sources associated with the Project and the four Wartsila generators nearing construction completion. Noise impacts for all five Wartsila generators were evaluated since these units are collocated in the same building and their noise sources are identical. There were 61 noise sources included in the model consisting of the five Wartsila engines, air intakes and exhausts as well as noise sources associated with the air radiator cooling fans. Sound level attenuation for the exhaust silencers (5), inlet silencers (5) and steel panels enclosing the equipment. The sound power levels and sound attenuation used in the analysis for the Project were based on updated information from

Wartsila on the “as delivered” Model W18V50SG generators, and are presented in Appendix C. The “as delivered” sound power levels provided by Wartsila reflect a change in the analysis previously conducted for the four Wartsila generators and are the latest data appropriate for determining noise impacts. The location of each noise source was based on its location in a computerized Project layout. The computerized drawing was imported into the CadnaA model for the noise analysis. The heights of the major structures were also input into CadnaA, developing a three-dimensional representation. Sources were input into CadnaA as point, area, and vertical area sources with appropriate dimensions.

The design of the Project includes components that mitigate noise from being emitted to the surrounding environment. The majority of the noise sources, such as the Wartsila engines, are located within enclosures or compartments that mitigate sounds emitted by equipment. The L_w used in the analysis for both the noise sources and attenuation equipment are presented in Appendix C. The atmospheric attenuation was set at the CadnaA default value, which is 10 degrees centigrade (°C) (50°F) and 70 percent relative humidity. The ground attenuation for the area was set to represent mixed adsorption to reflect a mixture of paved surfaces, water, and vegetation.

3.3.5 Impact Analysis

Table 3-5 presents the background noise levels for the four monitoring locations and the predicted noise impacts from five RICE generators at each monitoring location. The use of the “as delivered” sound power levels and attenuation equipment resulted in lower predicted sound levels than previously evaluated for the four Wartsila generators. The noise impacts were also predicted within the residential area northeast of the Hopkins Plant near the transmission corridor (approximately ¼ mile from the Project location). This corridor has no vegetation to attenuate noise. The overall noise level is the background noise level that is logarithmically combined with the predicted noise impacts. The background noise levels were developed using observed noise levels that include the operation of Unit 2A as well as other non-intermittent noise sources (e.g., HC-3 and HC-4) at the Hopkins Plant. The maximum noise impact with five RICE generators are predicted to increase noise levels only 1 dBA at Monitoring Location 4. Monitoring Location 4 is located along the transmission corridor southeast of the Hopkins Plant and not near any residential areas. The noise levels are predicted to increase less than 1 dBA within the residential area northeast of the Hopkins Plant along the transmission corridor. A difference of less than 3 dBA in SPLs is not noticeable by human hearing. In addition, the maximum predicted increase is within the typical margin of error (3 dBA) in noise modeling due to temporal changes in noise sources.

3.4 Water Use

As described in Section 2.4, cooling for the Wartsila 18V50SG is provided by a closed system with very minor water requirements (1 gallon/week). No impacts are expected to ground or surface water as the project will not require any additional water to be withdrawn from current sources at the plant or result in any additional surface or ground water discharge.

3.5 Stormwater

The wastewaters generated by the Project will include wash water, and equipment area stormwater. The previously-approved stormwater management system for the four Wartsila generators has been determined to meet the applicable requirements of the North Florida Water Management District (NFWMD), Leon County, FDEP, and EPA for the Project.

3.6 Changes in Non-Aquatic Species Populations

No adverse impacts to non-aquatic species are anticipated during operation of the Project, as the area proposed for the Project has been used for the existing Hopkins Generating Station facilities and does not provide significant suitable natural habitat for wildlife. The area designated for the Project has been significantly disturbed during construction and operation of the existing Hopkins facilities, including removal of forested vegetative communities and topographic grading. The open, cleared areas designated for location of the construction laydown and parking are not considered critical habitat for any species of wildlife. The surrounding forested parcels will continue to provide habitat for wildlife; therefore, construction and operation of the Project is not anticipated to result in the reduction of any populations of non-aquatic species.

No adverse impacts to federal- or state-listed terrestrial plants or animals are expected, due to the existing developed nature of the habitat within the Project area.

3.7 Traffic

Construction and operational traffic associated with the Project will access the Site from Geddie Road which is connected to U.S. 90 to the north of the Site and SR 20 south of the Site. Geddie Road is a two-lane road with annual average daily traffic (AADT) of 5,700 (FDOT Traffic Online (2018); <https://tdaappsprod.dot.state.fl.us/fto/>). The AADT truck traffic on Geddie Road is 473. U.S. 90 is a divided four-lane divided highway that is signalized at the intersection with Geddie Road. SR 20, Blounttown Highway is a two-lane highway that is not signalized and contains north-bound turn lanes. The AADT for U.S. 90 and SR 20 near the intersections with Geddie Road are 17,900 and 12,500, respectively. The AADT truck traffic for U.S. 90 and SR 20 near the intersections with Geddie Road are 1,647 and 1,075. Based on the nature of the roadways and reported AADT, roadways accessing the Site operate at acceptable Level-of-Service (LOS) (FDOT Generalized Average Annual Daily Volumes for Urban Areas). The peak amount of construction traffic, including construction workers and trucks, is a very small percentage of AADT and significantly under AADT volumes that would have unacceptable LOS.

3.8 Cultural and Archaeological Resources

Construction and operation of the Project is expected to have no effect on archaeological resources. No significant or potentially significant archaeological properties would be affected by construction and operation since the designated areas have been previously impacted. In the event that post-construction activities result in the discovery of archaeological materials, activities that have the potential to disturb those materials will be halted until an evaluation of their potential significance is made by a professional archaeologist. If the materials are believed to be significant, the State Historic Preservation Officer (SHPO) will be consulted to identify appropriate measures.

4.0 CONDITIONS OF CERTIFICATION

The current Conditions of Certification for the City of Tallahassee Arvoh B. Hopkins Power Plant (PA 74-030), were last modified August 8, 2017. The construction and operation of the Project will not require any revision to these existing Conditions of Certification. The submittal of the Air Construction/Prevention of Significant Deterioration Permit application and subsequent issuance of the Air Construction Permit and Title V Permit would be incorporated by reference pursuant to Condition A.V. A. The stormwater management plan has been developed with consideration of Condition Section A. V. B. 2. NPDES Generic Permit for Stormwater Discharge from Large, Condition Section A. V. B. 3. NPDES Multi-Sector Generic Permit for Stormwater Discharge Associated with Industrial Activity and Small Construction Activities, Condition Section A. XXVII. B. Surface Water Management Systems (SWMS) and Condition Section B. I. D. Stormwater Discharge.

TABLES

Table 3-1. City of Tallahassee, A. B. Hopkins Plant, Measured Sound Pressure Levels, March 2004

Noise Monitoring Location	Dates	Sound Levels (dBA)			
		L ₉₅	L ₅	L ₉₀	L _{eq}
1. Hopkins Plant Boundary - South of Generating Units	March 29 and 30, 2004	37	53	39	50
2. Hopkins Plant Boundary - Geddie Road Northwest of Generating Units	March 29 and 30, 2004	53	69	54	63
3. Hopkins Plant Boundary - Railroad Track Northeast of Generating Units	March 29 and 30, 2004	44	68	45	65
4. Hopkins Plant Boundary - Transmission Corridor Southeast of Generating Units	March 29 and 30, 2004	38	56	39	53

Source: Golder Associates Inc., 2018.

Table 3-2. City of Tallahassee, A. B. Hopkins Plant, Measured Sound Pressure Levels, February 2006

Noise Monitoring Location	Date	Time	Sound Levels (dBA)			
			L _{min}	L _{max}	L ₉₀	L _{eq}
1. Hopkins Plant Boundary - South of Generating Units	7-Feb-06	Daytime 1	45	61	47	49
	8-Feb-06	Daytime 2	50	58	50	52
	7-Feb-06	Nighttime	49	63	50	52
2. Hopkins Plant Boundary - Geddie Road Northwest of Generating Units	7-Feb-06	Daytime 1	48	82	50	68
	8-Feb-06	Daytime 2	48	80	50	66
	7-Feb-06	Nighttime	53	75	54	59
3. Hopkins Plant Boundary - Railroad Track Northeast of Generating Units	7-Feb-06	Daytime 1	46	54	47	49
	8-Feb-06	Daytime 2	47	57	48	49
	7-Feb-06	Nighttime	49	58	49	50
4. Hopkins Plant Boundary - Transmission Corridor Southeast of Generating Units	7-Feb-06	Daytime 1	41	55	42	45
	8-Feb-06	Daytime 2	45	54	46	48
	7-Feb-06	Nighttime	44	70	46	54

Source: Golder Associates Inc., 2018.

Table 3-3. City of Tallahassee, A. B. Hopkins Plant, Measured Sound Pressure Levels, August 2008

Monitoring Location-Run		Date	Time	Sound Levels (dBA)			
				L _{min}	L _{max}	L ₉₀	L _{eq}
1-1	Northeast of Hopkins Unit 2	11-Aug-08	Daytime	56.2	63.3	57.8	58.8
1-2		11-Aug-08	Nighttime	53.9	76.4	54.6	61.4
1-3		18-Aug-08	Daytime	51.2	82.2	56.2	62.5
1-4		18-Aug-08	Daytime	53.9	79.8	57.5	63.1
1-5		18-Aug-08	Daytime	56.1	67.1	58.5	60.3
1-6		18-Aug-08	Daytime	58.6	88.4	60.2	62.5
1-7		18-Aug-08	Daytime	58.1	63.0	59.4	60.4
1-8		19-Aug-08	Daytime	53.2	73.6	54.9	57.7
2-1	East of Hopkins Unit 2	11-Aug-08	Nighttime	53.8	60.6	54.8	55.4
2-2		18-Aug-08	Daytime	47.2	59.4	48.6	53.6
3-1	North of Hopkins Unit 2	18-Aug-08	Daytime	52.8	60.7	55.0	57.1
3-2		18-Aug-08	Daytime	56.8	64.3	58.8	60.6
3-3		19-Aug-08	Daytime	47.4	66.1	49.0	50.7

Source: Golder Associates Inc., 2018.

Table 3-4. City of Tallahassee, A. B. Hopkins Plant, Summary of Measured Sound Pressure Levels, March 2004, February 2006, and August 2008

Noise Monitoring Location	Dates		Sound Levels (dBA)			
			L ₉₅ /L _{min}	L ₅ /L _{max}	L ₉₀	L _{eq}
1. Hopkins Plant Boundary - South of Generating Units	March 29 and 30, 2004	24-hour	37	53	39	50
	February 7 and 8, 2006	Nighttime	49	63	50	52
	February 7 and 8, 2006	Daytime ^a	50	61	50	52
2. Hopkins Plant Boundary - Geddie Road Northwest of Generating Units	March 29 and 30, 2004	24-hour	53	69	54	63
	February 7 and 8, 2006	Nighttime	53	75	54	59
	February 7 and 8, 2006	Daytime ^a	48	82	50	68
3. Hopkins Plant Boundary - Railroad Track Northeast of Generating Units	March 29 and 30, 2004	24-hour	44	68	45	65
	February 7 and 8, 2006	Nighttime	49	58	49	50
	February 7 and 8, 2006	Daytime ^a	47	57	48	49
	August 11, 2008	Nighttime ^b	54	61	55	55
	August 18, 2008	Daytime ^b	47	59	49	54
4. Hopkins Plant Boundary - Transmission Corridor Southeast of Generating Units	March 29 and 30, 2004	24-hour	38	56	39	53
	February 7 and 8, 2006	Nighttime	44	70	46	54
	February 7 and 8, 2006	Daytime ^a	45	55	46	48

^a Maximum of the two observed sound daytime levels.

^b 2008 monitoring run 2-2 representing daytime sound levels.

Source: Golder Associates Inc., 2018.

Table 3-5. City of Tallahassee, A. B. Hopkins Plant, Five Wartsila Generators - Background Noise Levels and Predicted Noise Impacts

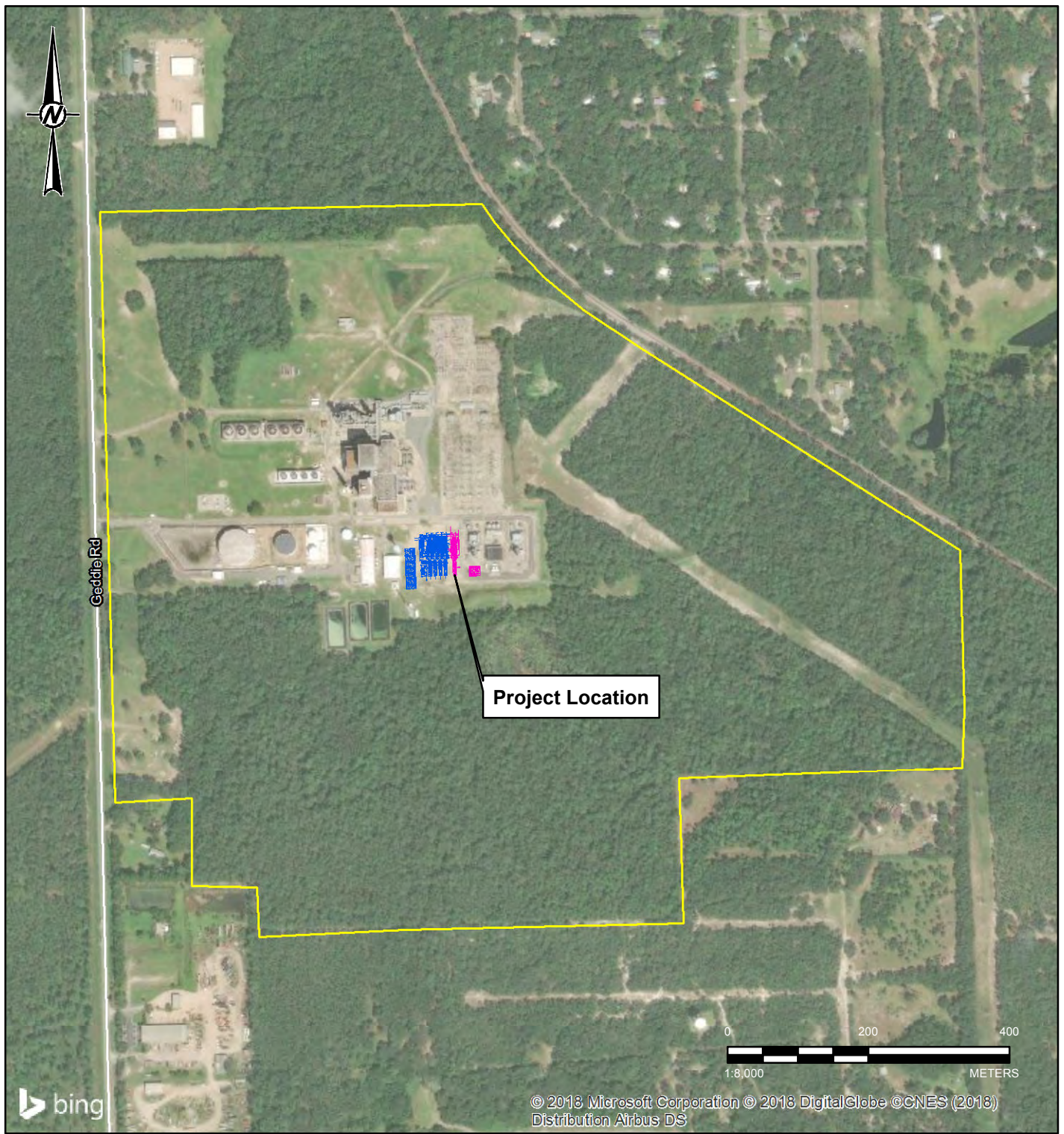
Noise Monitoring Location	Background Noise Level ^a (dBA)	Predicted Impacts - Five (5) Generators (dBA)	Overall Noise Level (dBA)	Increase (dBA)
1. Hopkins Plant Boundary - South of Generating Units	49.7	42.0	50.4	0.7
2. Hopkins Plant Boundary - Geddie Road Northwest of Generating Units	54.1	34.3	54.1	0.0
3. Hopkins Plant Boundary - Railroad Track Northeast of Generating Units	54.8	44.2	55.2	0.4
4. Hopkins Plant Boundary - Transmission Corridor Southeast of Generating Units	45.7	39.7	46.7	1.0
Residential Area - Near Transmission Corridor - Northeast of Hopkins Plant	54.8	46.5	55.4	0.6

^a Highest L₉₀ noise levels.

^b 2008 monitoring run 2-2 representing daytime sound levels.

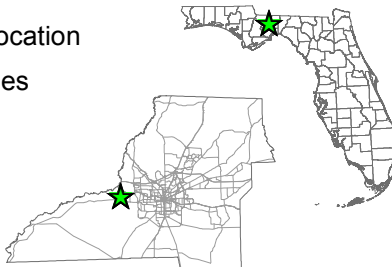
Source: Golder Associates Inc., 2018.

FIGURES



LEGEND

- ★ Proposed Project Location
- Four Wartsila Engines under construction
- Proposed Project
- Property Boundary



REFERENCE(S)

1. PROPERTY BOUNDARY, FLORIDA DEPARTMENT OF REVENUE, 2017.

COORDINATE SYSTEM: NAD 1983 UTM ZONE 16N
PROJECTION: TRANSVERSE MERCATOR
DATUM: NORTH AMERICAN 1983

CLIENT
CITY OF TALLAHASSEE

PROJECT
HOPKINS GENERATING STATION

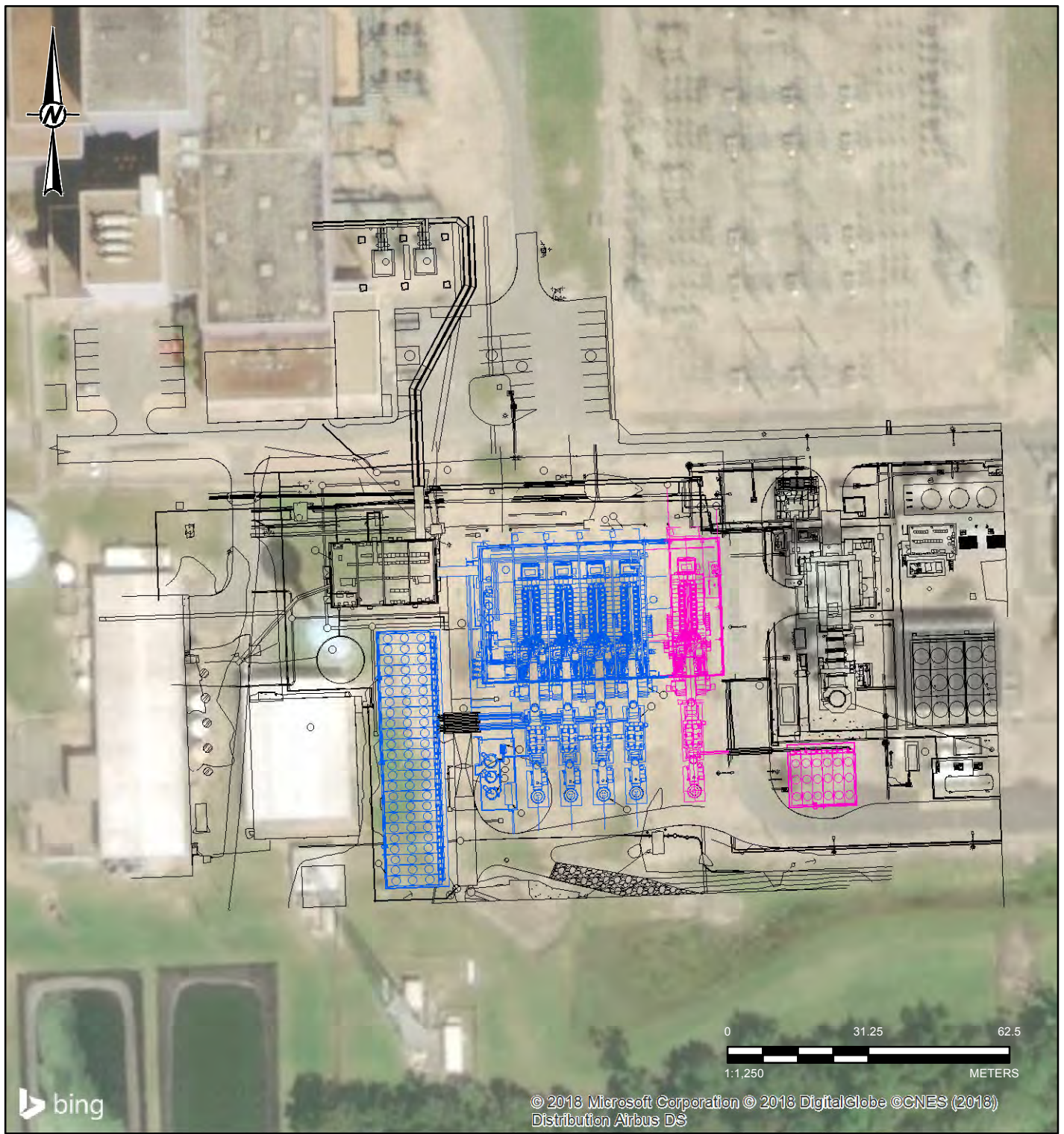
TITLE
**LOCATION OF PROPOSED PROJECT
AT THE A.B. HOPKINS STATION**

CONSULTANT	YYYY-MM-DD	2019-01-02
	DESIGNED	GFD
	PREPARED	GFD
	REVIEWED	MS
	APPROVED	SM



PROJECT NO. 18109057 CONTROL A001 REV. 0

FIGURE
1-1



LEGEND

- Four Wartsila Engines under construction
- Proposed Project
- Facility Plot Plan

REFERENCE(S)

COORDINATE SYSTEM: NAD 1983 UTM ZONE 16N
PROJECTION: TRANSVERSE MERCATOR
DATUM: NORTH AMERICAN 1983

CLIENT
CITY OF TALLAHASSEE

PROJECT
HOPKINS GENERATING STATION

TITLE
FACILITY PLOT PLAN

CONSULTANT	YYYY-MM-DD	2019-01-02
	DESIGNED	GFD
	PREPARED	GFD
	REVIEWED	MS
	APPROVED	SM



PROJECT NO. 18109057 CONTROL A005 REV. 0

FIGURE
2-1

Appendix A Air Construction/Prevention of Significant Deterioration Permit Application



Air Construction/Prevention of Significant Deterioration
Permit Application
City of Tallahassee
Arvah B. Hopkins RICE Engine Project
Leon County, Florida

Submitted to:

City of Tallahassee

300 South Adams Street
Tallahassee, FL 32301

Submitted by:

Golder Associates Inc.

6026 NW 1st Place Gainesville, Florida, USA 32607

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18109057

December 2018

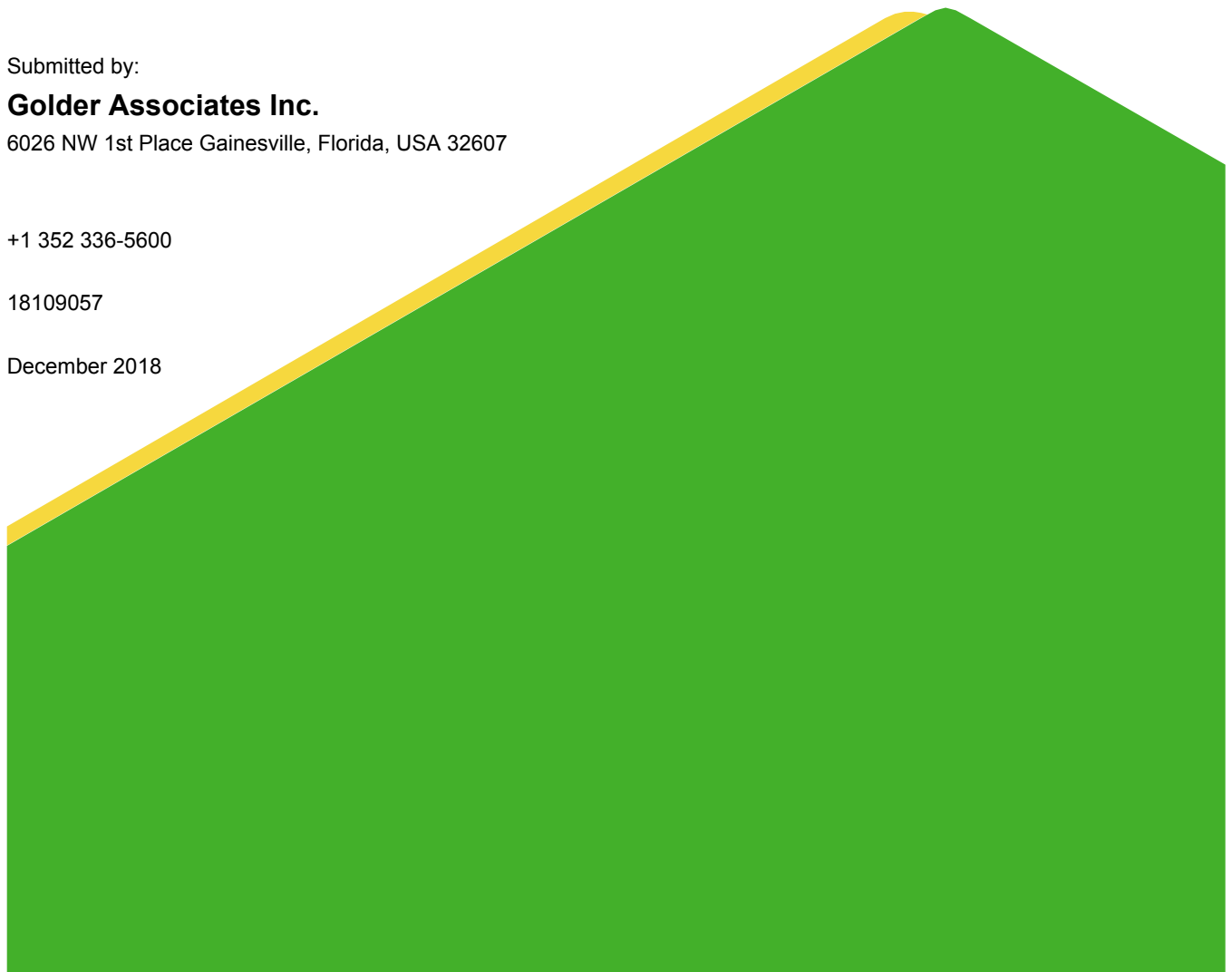


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APPENDIX A

Performance and Emissions Information and Calculations

APPENDIX B

Baseline Actual Information for Unit 1

APPENDIX C

FDEP Form No. 62-210.900(1): Application for Air Permit - Long Form

1.0 INTRODUCTION

The City of Tallahassee owns and operates the Arvah B. Hopkins Generating Station (“Hopkins”). Hopkins is an existing generating facility presently comprised of two steam electric generating units (Units 1 and 2A), two General Electric (GE) LM6000 combustion turbines (referred to as HC-3 and HC-4).

HC-3 and HC-4 began operation in 2005 and the initial startup of Unit 2A (a General Electric 7FA combined cycle combustion turbine) began commercial operation on May 2, 2008. These units are authorized to operate under Title V Air Operation Permit No. 0730003-017-AV issued by the Florida Department of Environmental Protection (FDEP).

The City of Tallahassee is nearly complete with installing four 18.82 megawatt (MW) natural gas fired generating units at the Hopkins Generating Station located in Leon County, Florida. This project was identified in the City of Tallahassee’s Ten-Year Site Plan: 2016-2025 (April 2016) submitted to the Florida Public Service Commission (FPSC). The four units are Wartsila Model 18V50SG four-cycle spark-ignition engines fired with natural gas and connected to associated electric generators. These reciprocating internal combustion engines (RICE) were authorized by the Florida Department of Environmental Protection (FDEP) Air Permit No. 0730003-015-AC (PSD-FL-441). As part of this authorization, the City of Tallahassee plans on retiring Unit 1, which provided emissions offsets for the four Wartsila generating units once these units are fully operational. Two small combustion turbines (CT-1 and CT-2) were also retired and dismantled to make room for the new units.

The City of Tallahassee identified in its latest Ten-Year Site Plan: 2018-2027 (April 2018), the need to add an additional 18.5 MW (nominal) RICE and associated electric generator (City of Tallahassee, 2018). In this application, the City of Tallahassee proposes to add an additional natural gas fired 18.82 MW Wartsila Model 18V50SG four-cycle spark-ignition engine and associated electric generator (the “Project”) to the four RICE generators currently under construction and nearing commercial operation. A site location map is presented in Figure 1-1, and the proposed engine and the four engines currently under construction are shown in the facility plot plan in Figure 1-2.

The FDEP and U.S. Environmental Protection Agency (EPA) have pre-construction review requirements for new major sources of air pollution or major modifications at existing major source facilities that exceed threshold amounts. These requirements are known as Prevention of Significant Deterioration (PSD) review. The procedures for determining applicability of the PSD permitting program to the Project are specified in FDEP Rule 62-212.400(2), Florida Administrative Code (F.A.C.). For each regulated pollutant, PSD is triggered as a “major modification” at an existing facility if the difference between the projected actual emissions and the baseline actual emissions equals or exceeds the PSD significant emission rate (SER) for that pollutant.

The installation of the four RICE generators authorized by FDEP Air Permit No. 0730003-015-AC required PSD review for several PSD pollutants when considering increases from the four RICE generators and contemporaneous emission reductions from Unit 1. The proposed Project including consideration of contemporaneous emission increases (four RICE generators) and decreases (Unit 1) will exceed the pre-construction review thresholds. As a result, the Project will be classified by FDEP as a major modification and will be subject to the PSD preconstruction permitting program for those pollutants that exceed the PSD SERs. PSD applicability and associated air modeling analyses considered all five RICE generators.

Golder Associates Inc. (Golder) has been contracted to prepare the Air Construction/PSD Application that addresses the FDEP requirements including source information, control technology review, air monitoring requirements, and an air quality impact analysis for the Project. The air quality impact analysis must demonstrate

that the Project's air impacts comply with the National Ambient Air Quality Standards (NAAQS) and PSD Increments. This report is divided into seven sections.

- Section 1.0 presents an introduction to the Project
- Section 2.0 presents a description of the Project, including detailed air emissions and stack parameters necessary for air modeling impact analyses and PSD applicability
- Section 3.0 provides a summary of the PSD and regulatory review requirements applicable to the Project
- Section 4.0 includes the control technology review including a Best Available Control Technology (BACT) analysis including GHG
- Section 5.0 discusses the ambient air monitoring analysis
- Section 6.0 presents a summary of the air modeling approach and results used in assessing compliance of the Project with NAAQS and PSD Increments
- Section 7.0 presents the additional impact analysis required for PSD review

Appendices which include emission calculations, baseline actual emissions information for Unit 1, and FDEP Form No. 62-210.900(1): Application for Air Permit – Long Form.

2.0 PROJECT DESCRIPTION, EMISSIONS AND STACK PARAMETERS

The Project will consist of one Wartsila Model 18V50SG natural gas fired generator that will produce 18.82 MW of electric power at 100 percent load for a total of 94.1 MW from a total of five Wartsila engines. Four Wartsila engines were authorized by Air Permit No. 0730003-015-AC (PSD-FL-441) issued on September 26, 21017 and construction is nearly complete. The Wartsila Model 18V50SG engine is a lean-burn engine with pre-chamber mixing and low peak combustion temperatures to reduce formation of nitrogen oxides (NO_x) while insuring proper combustion to minimize the emissions of carbon monoxide (CO) and volatile organic compounds (VOCs). The Wartsila Engine Control System (WECS) is designed to control each cylinder to insure optimal control and operation. The engine will also be equipped with selective catalytic reduction (SCR) to control NO_x emissions to 5 parts per million volume-dry (ppmvd) corrected to 15 percent O₂ and an oxidation catalyst to control CO emissions to 15 ppmvd corrected to 15 percent O₂. These emission rates were provided for emissions at 100 percent load, 70 percent and 40 percent load. Estimated non-greenhouse gas (GHG) pollutant emissions for the Wartsila engine for are presented in Table 2-1. Table 2-2 presents the maximum potential annual emissions based on six different operating loads scenarios. (Refer to Appendix A, Table A-1 through A-3, for detailed information.) Table 2-3 presents the maximum potential annual emission compared to the PSD review thresholds referred to as the SERs that are contained in in 62-210.200(234), F.A.C., and shown in Table 2-3. The maximum potential emissions of the Project were determined to be at 100 percent load and 8,760 hours per year (hr/yr) operation.

The selection of the Wartsila Model 18V50SG gas engines (four RICE being installed and the Project) was based on an evaluation of the City of Tallahassee's generation needs and existing generation resources, some of which are reaching their useful life and will be retired. The advantages of the RICE generators include, among others (City of Tallahassee, 2018-2027 Ten-Year Site Plan):

- The RICE generators are more efficient than the units that are being retired providing significant potential fuel savings. The retired units represented approximately 132 MW of capacity.
- The RICE generators can be started and reach full load within 5 to 10 minutes. In addition, their output level can be changed very rapidly. This, coupled with the number and size of each unit, makes them excellent for responding to the changes in output from intermittent resources such as solar energy systems and may enable the addition of more solar resources in the future.
- Multiple RICE generators provide greater dispatch flexibility, in addition to aiding the City in complying with the federally enforced reliability standards.
- The CO₂ emissions from the RICE generators are much lower than the units scheduled to be retired.

On June 3, 2010, EPA promulgated regulations related to PSD and Title V GHG permitting [75 Federal Register (FR) 31514-31608]. In EPA's promulgation, GHGs are defined to include an aggregate group of six GHGs: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF₆). Each of these GHGs has a specific Global Warming Potential that is calculated as "CO₂ equivalent emissions" or CO₂e that is equivalent to one ton of CO₂. For the Project, the GHGs emitted are CO₂, CH₄, and N₂O with one ton of CH₄ equivalent to 25 tons of CO₂e and one ton of N₂O equivalent to 298 tons of CO₂e. GHGs for the Project were calculated based on the actual annual heat input and emission factors from 40 Code of Federal Regulations (CFR) 75, Appendix G for CO₂ and 40 CFR Part 98, Subpart C. Table 2-3 also presents a summary of the GHG emissions for the Project. (Refer to Appendix A, Table A-4, for detailed information.)

Because the Project involves a physical change to an existing major stationary source that will result in an increase in actual emissions, review is required to determine whether the Project constitutes a major modification triggering PSD requirements under Rule 62-212.400, F.A.C. PSD applicability is determined on a pollutant-by-pollutant basis and, as defined in Rule 62-210.200(151), a "Major Modification" occurs where there is a "significant emission increase" of a PSD pollutant and a "significant *net* emissions increase" of that pollutant that exceeds the SERs. This Project involves the construction of a new emission unit (an additional Wartsila engine) that would be contemporaneous with emission increases (the four RICEC generators being installed) and decreases (the retirement of Unit 1 and CT-1 and CT-2) the net emissions of all units must be considered. A significant *net* emissions increase is determined by accounting for all other contemporaneous and creditable increases or decreases in actual emissions. For an existing emission unit like Unit 1, the emission decreases are determined based on "baseline actual emissions" as defined in Rule 62.210.200(28), F.A.C. The "baseline actual emissions" are the emissions over a consecutive 24-month period within the 5 years immediately preceding the date that a complete application is submitted. The use of different consecutive 24-month periods for each pollutant is allowed. The net emission increase is determined from the sum of all the contemporaneous creditable increases and decreases. For new units, such as the four RICE being installed, emission increases are based on "potential to emit" as defined in Rule 62.210.200(201), F.A.C.

Table 2-4 summarizes the annual Unit 1 emissions reported in the annual operating reports (AORs) for each calendar year in the period 2013 through 2017. During this period, Unit 1 only used natural gas as fuel with no reported use of fuel oil. The CO₂ emission rates in Tables 2-4 were obtained from EPA's acid rain database. Since emissions of N₂O and CH₄ were not reported in the AORs, they were calculated based on the actual annual heat input and emission factors from 40 CFR 98, Subpart C. Appendix B, Tables B-1, B-2 and B-3 present the Unit 1 2013-2017 heat input, the 2013-2017 AOR information and the 2013-2017 GHG calculations, respectively.

Table 2-5 presents the PSD applicability for the Project with the emission increases from the four RICE generators and emission offsets from retiring Unit 1. As shown in Table 2-5, there are significant net emissions increases requiring PSD review for VOCs, PM, PM₁₀, PM_{2.5} and GHGs. The net emissions increases for NO_x and CO are less than the PSD significant emission rate.

3.0 AIR QUALITY REVIEW REQUIREMENTS AND APPLICABILITY

3.1 National Ambient Air Quality Standards

The existing applicable NAAQS are presented in Table 3-1. Primary NAAQS were promulgated to protect the public health with an adequate margin of safety and secondary NAAQS were promulgated to protect the public welfare from any known or anticipated adverse effects associated with the presence of pollutants in the ambient air. Areas of the country in compliance with NAAQS like Leon County are designated as attainment areas.

3.2 PSD Requirements

3.2.1 General Requirements

Under federally approved Florida PSD review requirements, all major new or modified sources of air pollutants regulated under the Clean Air Act (CAA) must be reviewed and a pre-construction permit issued.

PSD is applicable to any new “major stationary source” and “major modifications” that occur at existing major stationary sources. A major stationary source is defined as any 1 of 28 named source categories that have the potential to emit 100 tons per year (TPY) or more, or any other stationary facility that has the potential to emit 250 TPY or more, of any pollutant regulated under the CAA. “Potential to emit” means the capability, at maximum design capacity, to emit a pollutant after the application of control equipment. Net emission increases from a modification at a major stationary source that exceed the PSD SERs are also subject to PSD review.

EPA has promulgated regulations providing that certain increases above an air quality baseline concentration level of sulfur dioxide (SO₂), PM₁₀, and NO₂ concentrations would constitute significant deterioration. The EPA class designations and allowable PSD Class I and II increments are presented in Table 3-1. The nearest PSD Class I areas to the Hopkins Generating Station is the Bradwell Bay National Wilderness Area (NWA), located approximately 28 kilometers (km) southwest of the Station, and the St. Marks NWA, located about 38 km to the south. Florida has adopted the EPA class designations and allowable PSD increments for SO₂, PM₁₀, and NO₂.

PSD review is used to determine whether significant air quality deterioration will result from the new or modified facility. Florida’s PSD regulations are found in FDEP Rule 62-212.400, F.A.C. Major new facilities and major modifications are required to undergo the following analysis related to PSD for each pollutant emitted in significant amounts:

- 1) Control technology review
- 2) Source impact analysis
- 3) Air quality analysis (monitoring)
- 4) Source information
- 5) Additional impact analyses

In addition to these analyses, a new major stationary source or major modification made to an existing major stationary source also must be reviewed with respect to Good Engineering Practice (GEP) stack height regulations. Discussions concerning each of these requirements for a new major stationary source or major modification are presented in the following sections.

3.2.2 Control Technology Review

A new major stationary source or major modification must perform a control technology review, which requires that all applicable federal and state emission limiting standards be met and that BACT be applied to control emissions from the source (FDEP Rule 62-212.400, F.A.C.). The BACT requirements are applicable to all regulated pollutants for which the net emissions increase from the facility or modification exceeds the SER.

BACT is defined in FDEP Rule 62-210.200(32), F.A.C., as:

(a) An emission limitation, including a visible emissions standard, based on the maximum degree of reduction of each pollutant emitted, which the Department, on a case-by-case basis, determines is achievable through application of production processes and available methods, systems and techniques (including fuel cleaning or treatment or innovative fuel combustion techniques) for control of each such pollutant taking into account:

1. Energy, environmental and economic impacts, and other costs,
2. All scientific, engineering, and technical material and other information available to the Department, and
3. The emission limiting standards or BACT determinations of Florida and any other State.

(b) If the Department determines that technological or economic limitations on the application of measurement methodology to a particular part of an emissions unit or facility would make the imposition of an emission standard infeasible, a design, equipment, work practice, operational standard or combination thereof, may be prescribed instead to satisfy the requirement for the application of BACT. Such standard shall, to the degree possible, set forth the emissions reductions achievable by implementation of such design, equipment, work practice or operation.

(c) Each BACT determination shall include applicable test methods or shall provide for determining compliance with the standard(s) by means which achieve equivalent results.

(d) In no event shall application of best available control technology result in emissions of any pollutant which would exceed the emissions allowed by any applicable standard under 40 CFR Parts 60, 61, and 63.

The BACT requirements are intended to ensure that the control systems incorporated in the design of a new facility reflect the latest in control technologies used in a particular industry and take into consideration existing and future air quality in the vicinity of the new facility. BACT must, at a minimum, demonstrate compliance with NSPS for a source (if applicable). An evaluation of the air pollution control techniques and systems, including a cost benefit analysis of alternative control technologies capable of achieving a higher degree of emission reduction than the proposed control technology, is required. The cost-benefit analysis requires the documentation of the materials, energy, and economic penalties associated with the proposed and alternative control systems, as well as the environmental benefits derived from these systems. A decision on BACT is to be based on sound judgment, balancing environmental benefits with energy, economic, and other impacts (EPA, 1978).

3.2.3 Source Impact Analysis

A source impact analysis must be performed for a new major stationary source or major modification to a major source for each pollutant, subject to PSD review, for which the net emissions increase exceed the SER (refer

Table 2-5). The PSD regulations specifically provide for the use of atmospheric dispersion models in performing impact analyses, estimating baseline and future air quality levels, and determining compliance with NAAQS and allowable PSD increments. Designated EPA models that are approved by FDEP normally must be used in performing the impact analysis. Specific applications for other than EPA approved models require EPA's consultation and prior approval. Guidance for the use and application of dispersion models is presented in the EPA publication *Guideline on Air Quality Models (Revised)*. The source impact analysis for criteria pollutants to address compliance with NAAQS and PSD Class II increments may be limited to the new source if the impacts as a result of the new source are below significant impact levels, as presented in Table 3-1.

The EPA has proposed significant impact levels for Class I areas. Although these levels have not been officially promulgated as part of the federal PSD regulations and may not be binding for states in performing PSD reviews, the levels serve as a guideline in assessing a source's impact in a Class I area. FDEP has accepted the use of these significant impact levels.

Various lengths of meteorological data records can be used for impact analysis. A 5-year period can be used with corresponding evaluation of highest, second highest short term concentrations for comparison to NAAQS or PSD increments. The term "highest, second highest" (HSH) refers to the highest of the second highest concentrations at all receptors (i.e., the highest concentration at each receptor is discarded). The second highest concentration is significant because short-term NAAQS specify that the standard should not be exceeded at any location more than once a year. If fewer than 5 years of meteorological data are used in the modeling analysis, the highest concentration at each receptor normally must be used for comparison to air quality standards.

Because there are no NAAQS or PSD increments applicable to GHG emissions, these analyses are not conducted for PSD review for GHG.

3.2.4 Source Information/GEP Stack Height

Source information must be provided to adequately describe the proposed facility or major modification subject to PSD review.

The 1977 CAA Amendments require that the degree of emission limitation required for control of any pollutant cannot be affected by a stack height that exceeds GEP or any other dispersion technique. On July 8, 1985, EPA promulgated final stack height regulations (EPA, 1985a). Identical regulations have been adopted by FDEP (FDEP Rule 62-210.550, F.A.C.). GEP stack height is defined as the highest of:

1. 65 meters; or
2. A height established by applying the formula:

$$H_g = H + 1.5 L$$

where:

H_g = GEP stack height,

H = Height of the structure or nearby structure, and

L = Lesser dimension (height or projected width) of nearby structure(s); or

3. A height demonstrated by a fluid model or field study.

“Nearby” is defined as a distance up to 5 times the lesser of the height or width dimensions of a structure or terrain feature, but not greater than 0.8 km. Although GEP stack height regulations require that the stack height used in modeling for determining compliance with NAAQS and PSD increments not exceed the GEP stack height, the actual stack height may be greater.

The stack height regulations also allow increased GEP stack height beyond that resulting from the above formula in cases where plume impaction occurs. Plume impaction is defined as concentrations measured or predicted to occur when the plume interacts with elevated terrain. Elevated terrain is defined as terrain that exceeds the height calculated by the GEP stack height formula.

3.2.5 Additional Impact Analysis

In addition to air quality impact analyses, Florida PSD regulations require analyses for applicable pollutants of the impairment to visibility and the impacts on soils and vegetation that would occur as a result of a new major stationary source or major modification subject to PSD review [FDEP Rule 62-212.400(8)(a), F.A.C.]. These analyses are required for each pollutant emitted in significant amounts (refer to Table 2-5).

Because GHG emissions will not cause visibility impairment or direct impacts to soils and vegetation, these analyses are not conducted for PSD review for GHGs.

3.2.6 Air Quality Related Values

An Air Quality Related Value (AQRV) analysis is required for projects for those pollutants undergoing PSD review to assess the potential impact on AQRVs in PSD Class I areas. AQRVs have been established for the Saint Marks NWA. The U.S. Department of the Interior in 1978 administratively defined AQRVs to be:

All those values possessed by an area except those that are not affected by changes in air quality and include all those assets of an area whose vitality, significance, or integrity is dependent in some way upon the air environment. These values include visibility and those scenic, cultural, biological, and recreational resources of an area that are affected by air quality.

Important attributes of an area are those values or assets that make an area significant as a national monument, preserve, or primitive area. They are the assets that are to be preserved if the area is to achieve the purposes for which it was set aside (Federal Register, 1978).

The AQRVs include visibility, freshwater and coastal wetlands, dominant plant communities, unique and rare plant communities, soils and associated periphyton, and the wildlife dependent on these communities for habitat. Rare, endemic, threatened, and endangered species of the NP and bioindicators of air pollution (e.g., lichens) must also be evaluated.

4.0 CONTROL TECHNOLOGY REVIEW

4.1 Introduction

The Project is subject to FDEP regulations that require an air permit prior to construction and demonstration of conformance with appropriate emission standards and PSD requirements such as control technology review. Applicable requirements for construction permits and approvals are contained in FDEP Chapters 62-4, 62-210, and 62-212, F.A.C. Applicable federal emissions standards have been adopted by reference in Rule 62-204.800, F.A.C. FDEP emission standards applicable for some sources and designated areas are set forth in Chapter 62-296, F.A.C. Provisions for certain excess emissions are contained Rule 62.210.700, F.A.C. Emission monitoring

requirements that included requirement for sampling facilities are contained in Chapter 62-297, F.A.C. For the Project, the most stringent emissions standards are discussed in the following sections and include federal emission standards and those proposed as BACT.

4.1.1 Emission Limiting Standards [(New Source Performance Standards (NSPS) and National Emission Standards for Hazardous Air Pollutants (NESHAPS)]

The applicable NSPS for the Wartsila 18V50SG engine is 40 CFR Part 60, Subpart JJJJ – Standards of Performance for Spark Ignition Internal Combustion Engines (ICE). These emission standards have been adopted by reference in Rule 62-204.800(8)(b)82, F.A.C. The NSPS standards applicable to the proposed Wartsila engine are those for engines that are manufactured after July 1, 2010 with a rating greater than 500 horsepower (hp) and are spark-ignition lean burn ICE. The Wartsila engine/generator that produce 18.82 MW which is equivalent to over 25,000 hp. Subpart JJJJ establishes notification, emission limiting standards, maintenance plan, monitoring, reporting and record-keeping requirements for NO_x, CO, and VOCs. The emission limiting standards are (Table 1 to Subpart JJJJ):

- NO₂ – 1 grams(gr)/hp-hr or 82 ppmvd corrected to 15% O₂
- CO – 2 gr/hp-hr or 270 ppmvd corrected to 15% O₂
- VOC – 0.7 gr/hp-hr or 60 ppmvd corrected to 15% O₂

The Wartsila engine without SCR can comply with the Subpart JJJJ requirements with estimated emissions using the WECS lean-burn technology of 0.9 gr/hp-hr for NO_x and 0.8 gr/hp-hr for CO (Sutkowski, M, 2011). The VOC emissions are 2.4 gr/hp-hr and require an oxidation catalyst to achieve the Subpart JJJJ emissions limits. With the addition of SCR and oxidation catalyst, the maximum emissions for the project over the range of operating conditions (i.e., 100% load to 40% load) are:

- NO₂ – 0.05 grams(gr)/hp-hr or 5 ppmvd corrected to 15% O₂
- CO – 0.1 gr/hp-hr or 15 ppmvd corrected to 15% O₂
- VOC – 0.16 gr/hp-hr or 26 ppmvd corrected to 15% O₂

With the combination of combustion controls and SCR/oxidation catalyst, the emissions for the project will be well below the Subpart JJJJ requirements.

The applicable NESHAP for the Wartsila 18V50SG engine is 40 CFR Part 63, Subpart ZZZZ – Stationary Reciprocating Internal Combustion Engine (RICE). This NESHAP is applicable to compression ignition and spark ignition engines at a major source or minor source of Hazardous Air Pollutants (HAPs). Subpart ZZZZ establishes notification, emission standards and operating limitations, continuous compliance provisions, monitoring, reporting and record-keeping requirements. These emission standards have been adopted by reference in Rule 62-204.800(11)(b)82, F.A.C. The Wartsila Model 18V50SG is considered a four-stroke lean-burn (4SLB) stationary RICE under Subpart ZZZZ. Since the Hopkins Plant is classified as a major source of HAPS (Title V Permit No. 073003-017-AV), the emission limiting standards are (Table 2a to Subpart ZZZZ):

- Reduce CO emissions by 93 percent; or
- Limit formaldehyde concentration in the stationary RICE exhaust to 14 ppmvd or less at 15 percent O₂

The installation of the oxidation catalyst on the Wartsila engine will result in compliance with either of the Subpart ZZZZ requirements.

4.1.2 Control Technology Overview

The use of clean fuel (natural gas) and combustion controls will minimize air emissions and ensure compliance with applicable emission-limiting standards. Using clean fuels will minimize emissions of SO₂, sulfuric acid mist (SAM), PM/PM₁₀/PM_{2.5} and other fuel bound contaminants. Combustion controls will minimize the formation of NO_x as well as the formation of CO and VOCs. Further NO_x reduction will be achieved by SCR. For CO and VOCs, an oxidation catalyst will further reduce emissions. The combination of these techniques has been determined to represent BACT and lowest achievable emission rate (LAER) on previous projects using the Wartsila Model 18V50SG engines. The following subsections present a summary of the best available control technology and practices for the Project.

4.1.3 Applicability and BACT Approach

The PSD regulations require new major stationary sources or major modifications to existing major stationary sources to undergo a control technology review for each pollutant that may potentially be emitted above significant amounts. The CAA specifies that BACT cannot be less stringent than any applicable standard of performance under the NSPS standards. Subsection 4.2 presents the BACT analysis for non-GHG pollutants consisting of VOCs and PM/PM₁₀/PM_{2.5}.

The approach to the BACT analysis is based on the regulatory definitions of BACT, as well as consideration of EPA's current guidelines suggesting that a "top-down" approach be followed in BACT analyses. The CAA and corresponding implementing regulations require that a BACT analysis be conducted on a case-by-case basis taking into consideration the amount of emissions reductions that each available emissions reducing technology or technique would achieve, as well as the energy, environmental, economic, and other costs associated with each technology or technique.

EPA has recommended since 1990 that permitting authorities use the five step "top down" BACT process to determine BACT. The top down process calls for all available control technologies for a given pollutant to be identified and ranked in descending order of control effectiveness. The permit applicant should first examine the highest ranked ("top") option. The top ranked options should be established as BACT unless the permit applicant demonstrates to the satisfaction of the permitting authority that technical considerations, or energy, environmental, or economic impacts justify a conclusion that the top ranked technology is not "achievable" in that case. If the most effective control strategy is eliminated in this fashion, then the next most effective alternative should be evaluated, and so on, until an option is selected as BACT.

EPA has broken down this "top down" process into the following five steps:

- Step 1: Identify all available control technologies
- Step 2: Eliminate technically infeasible options
- Step 3: Rank remaining control technologies
- Step 4: Evaluate most effective controls and document results
- Step 5: Select the BACT

4.2 Non-GHG Control Technology Review – BACT Analysis

4.2.1 VOCs

4.2.1.1 Previous BACT Determinations

As part of the BACT analysis, a review was performed of previous VOC BACT determinations for similar engines in EPA's RBLC database and permit searches for Wartsila 4SLB stationary RICE. BACT determinations issued within the last 10 years (i.e., since 2008) were identified.

Table 4-1 presents a summary of BACT determinations for internal combustion engines. These projects range from emergency engines to project similar to the Project. From the review of previous BACT determinations, it is evident that all VOC BACT determinations for natural gas RICE for similar projects have been based on good combustion practices (GCP) and the installation of oxidation catalysts. The South Texas Electric Cooperative, Inc. (STEC) Red Gate Power Project consists of 12 Wartsila 18V50SG 4SLB engines. The VOC BACT emission limit established by the Texas Commission on Environmental Quality (TCEQ) was 0.3 grams/hp-hr. The use of combustion controls and oxidation catalyst have also been determined as LAER. For example, the Wolf Technology Center 1 Combined Heat and Power Plant (CHP), which consisted of three Wartsila 18V50SG engines, proposed a VOC emission limit as LAER of 26 ppmvd corrected to 15 percent O₂ and 0.286 lb/MWh using combustion controls and oxidation catalyst. The VOC emissions from the Project as provided in Table 2-1 at 4.92 lb/hr at full load with combustion controls and oxidation catalyst are equivalent to 26 ppmvd corrected to 15 percent O₂, 0.26 lb/MWh, and 0.1 gr/hp-hr is below BACT limits for recent similar projects and is proposed as BACT.

4.2.1.2 Identification of Potentially Applicable Control Technologies

Combustion is a thermal oxidation process in which carbon and hydrogen contained in a fuel combine with oxygen in the combustion zone to form CO₂ and H₂O. Incomplete combustion occurs when there is not enough oxygen to allow the fuel to react completely to produce CO₂ and water. VOCs are a result of incomplete or partial combustion of fossil fuel. Carbon in the fuel that does not experience the required temperature or residence time will form CO or other organic compounds (e.g., VOCs) instead of being fully oxidized to CO₂. The important parameters in VOC formation are combustion temperatures, fuel residence time, and local stoichiometric ratio of fuel and air (i.e., mixing of fuel and air) while also limiting NO₂ emissions. The addition of oxidation catalyst provides downstream combustion of CO and VOCs that are a result of the combustion process.

The following control options are evaluated in the BACT analysis.

Combustion Controls

VOC emissions are generated from the incomplete combustion of carbon in the fuel and organic compounds. Optimization of the combustion chamber designs and operation practices that improve the oxidation process and minimize incomplete combustion is the primary mechanism available for lowering VOC emissions. This process is often referred to as combustion controls. The combustion system design of the WECS provides all of the factors required to facilitate complete combustion while limiting the formation of NO_x. These factors include a pre-chamber for mixing of air and fuel in the proper proportions, extended residence time, and consistent high temperatures in the combustion chamber. As a result, VOC emissions are limited while reducing the formation of NO_x.

Oxidation Catalyst

Catalytic oxidation technology is primarily designed to reduce CO emissions as well as VOC emissions. Oxidation catalysts operate at elevated temperatures ($>650^{\circ}\text{F}$). In the presence of an oxidation catalyst, excess O_2 in the exhaust reacts with VOCs to form CO_2 and water (H_2O). No chemical reagent is necessary. The oxidation catalyst is constructed with a highly porous substrate that is typically coated with a precious metal catalyst. The catalyst is designed specifically for the application to minimize backpressure and engine efficiency losses. None of the catalyst components is considered toxic and can be recycled.

4.2.1.3 Evaluation of Technically Feasible Control Alternatives

In this section, the technical feasibility of each potentially applicable control technology is assessed. Those technologies that are found to be technically infeasible will not be considered further in the BACT analysis.

Combustion Controls

Combustion controls have been applied successfully on 4SLB gas-fired engines similar to those proposed for the Project and are considered technically feasible.

Oxidation Catalyst

Oxidation catalyst technology has been applied successfully on Wartsila engines including in Florida on engines similar to those proposed for the Project and is technically feasible for the Project.

4.2.1.4 Ranking of Technically Feasible Control Alternatives

Combustion controls and oxidation catalyst are compatible technologies and are considered together in combination as the top control option for VOC; thus, a ranking is not required to establish the top technology.

4.2.1.5 Evaluation of Economic, Environmental, and Energy Impacts of Feasible Technologies

The capital and annual costs for oxidation catalyst for a Wartsila Model 18V50SG engine were estimated using EC/R Incorporated's (EC/R) Control Cost for Existing Stationary SI RICE. The EC/R analysis includes costs for installing oxidation catalysts on 4SLB gas engines and was submitted to EPA Office of Air Quality Planning and Standards (EC/R, 2010). The annualized cost for each engine is estimated to be approximately \$32,600/year based on an equipment life of 10 years and an interest rate of 7 percent. The uncontrolled VOC emissions for each engine are estimated to be 99 lb/hr and 434 TPY (3.2 g/kWh from Sutkowski, 2011). The cost effectiveness is calculated to be \$80.6 per ton of VOC removed for each engine ($\$32,600 \div 412$ tons VOC removed). Using the VOC emissions with only combustion controls, the cost effectiveness is less than \$100 per ton of VOC removed and therefore cost effective for this application. The oxidation catalyst will also remove an estimated 171 TPY of CO and 48 TPY of formaldehyde. This would lower the overall cost effectiveness of the installation of oxidation catalyst to \$58 per ton of pollutant removed, while also achieving emission rates that can meet NSPS and NESHAPS requirements.

The study provided also found no energy penalties for the addition of oxidation catalyst on 4SLB engines evaluated. Since there is no reactant used in an oxidation catalyst and no significant energy losses, there are no additional environmental impacts. Also, the addition of an oxidation catalyst also significantly reduces CO emissions (90+%). An oxidation catalyst in conjunction with the WECS will also limit formaldehyde emissions. Thus, there are multiple benefits to the installation of an oxidation catalyst.

4.2.1.6 Selection of BACT and Rationale

The evaluation of the energy, environmental, and economic impacts demonstrates that an oxidation catalyst system is cost effective for the Project. Therefore, GCP and oxidation catalyst are the proposed as the technology to meet BACT emission limits for VOC with the following emissions limits of 26 ppmvd corrected to 15 percent O₂ at full and 70% load and 42 ppmvd corrected to 15 percent O₂ at 40% load.

4.2.2 Particulate Matter (PM/PM₁₀/PM_{2.5})

4.2.2.1 Previous BACT Determinations

A small amount of PM/PM₁₀/PM_{2.5} emissions, collectively referred to as “PM” will result from the combustion of pipeline quality natural gas. PM emissions from combustion of natural gas are inherently low. NSPS Subpart JJJJ, which specifies performance standards for stationary 4SLB ICE, does not set any PM emissions limits.

As part of the BACT analysis, a review was performed for previous BACT determinations for PM emissions from large gas fired ICE engines (>500 hp) in EPA’s RBLC web page (see Table 4-2) . The dominant BACT for PM/PM₁₀/PM_{2.5} is the use of clean fuels and GCP. Add-on PM control technologies were not selected as BACT for any of the determinations. The STEC Red Gate and Wolf Technology Center 1 CHP projects that utilize the Wartsila 18V50SG 4SLB ICE engines and similar to the proposed Project, both recognize clean fuels and GCP as BACT.

4.2.2.2 Identification of Potentially Applicable Control Technologies

PM is the general term for a mixture of solid particles and liquid droplets present in the emissions stream. PM emissions from turbines primarily result from carryover of noncombustible trace constituents in the fuel. PM emissions can be classified as “filterable” or “condensable” PM. Filterable PM is that portion of the total PM that exists in the stack in either the solid or liquid state. Condensable PM is that portion of the total PM that exists as a gas in the stack but condenses in the cooler ambient air to form particulate matter. Condensable PM is composed of organic and inorganic compounds and is generally considered to be all less than 1.0 micron in aerodynamic diameter.

PM emissions that are less than 10 microns in diameter are referred to as PM₁₀. PM_{2.5} is PM emissions that are less than 2.5 microns in diameter. All PM₁₀ emissions are considered to be PM_{2.5}. The following control options are evaluated in the PM BACT analysis:

Good Combustion Practices (GCP)

PM emissions from natural gas combustion are inherently low, and combustion controls can further minimize the amount of PM emissions generated due to incomplete combustion. Optimization of the combustion chamber designs and operation practices that improve the oxidation process and minimize incomplete combustion are the primary mechanisms available for lowering PM emissions. This is often referred to as “good combustion practices.” Good combustion practices are inherent in modern Wartsila 18V50SG engines with WECS.

Clean Fuel

One mechanism for the formation of particulate is the oxidation of sulfur compounds, which can precipitate as PM in the exhaust stream. The proposed engine will burn pipeline-quality natural gas. Natural gas contains very low levels of sulfur; thus, emissions of sulfur and the resulting PM are minimized through the use of these clean-burning fuels.

Fabric Filter Baghouse

A fabric filter baghouse removes particles and condensed metals from a flue gas stream by drawing dust-laden flue gas and condensable through a bank of filter tubes suspended in a housing. A filter cake, composed of the removed particulate, builds up on the “dirty” side of the bag. Periodically, the cake is removed through physical mechanisms (i.e., blast of compressed air from the clean side of the bag, mechanical shaking of the bags, etc.), which causes the cake to fall. The dust is then collected in a hopper and removed.

Electrostatic Precipitator

An electrostatic precipitator (ESP) removes dust or other fine particles from a flue gas stream by charging the particles inductively with an electric field and then attracting the particles to highly charged collector plates, from which they are removed. An ESP consists of a hopper-bottomed box containing rows of plates forming passages through which the flue gas flows. Centrally located in each passage are emitting electrodes energized with a high-voltage, negative polarity direct current. The voltage applied is high enough to ionize the gas molecules close to the electrodes, resulting in a corona current of gas ions from the emitting electrodes across the gas passages to the grounded collecting plates. When passing through the flue gas, the charged ions collide with, and attach themselves to, fly ash particles suspended in the gas. The electric field forces the charged particles out of the gas stream towards the grounded plates, and there they collect in a layer. The plates are periodically cleaned by a rapping system to release the ash layer into ash hoppers as an agglomerated mass.

Wet Electrostatic Precipitator

A wet electrostatic precipitator (WESP) operates in the same three-step process as a dry ESP: charging, collection, and removal. Unlike with a dry ESP, however, with a WESP the removal of particles from the collecting electrodes is accomplished by washing the collection surface using liquid, rather than mechanically rapping the collector plates. WESPs are more widely used in applications where the gas stream has a high moisture content, is below the dew point, or includes “sticky” particulate.

Wet Scrubber

Wet scrubbers trap suspended particles by direct contact with a spray of water or other liquid. In effect, a scrubber washes the particulates out of the dirty airstream as they collide with and are entrained by the tiny droplets in the spray. Several configurations of wet scrubbers are in use. In a spray-tower scrubber, an upward-flowing airstream is washed by water sprayed downward from a series of nozzles. The water is re-circulated after it is sufficiently cleaned to prevent clogging of the nozzles. In orifice scrubbers and wet-impingement scrubbers, the air and droplet mixture collides with a solid surface. Collision with a surface atomizes the droplets, reducing droplet size and thereby increasing total surface contact area. These devices have the advantage of lower water-recirculation rates.

Scrubber efficiency depends on the relative velocity between the droplets and the particulates. Venturi scrubbers achieve high relative velocities by injecting water into the throat of a venturi channel—a constriction in the flow path through which particulate-laden air is passing at high speed. As a result, Venturi scrubbers are the most efficient of the wet collectors.

4.2.2.3 Evaluation of Technically Feasible Control Alternatives

Technical feasibility of the potential control options is evaluated below. Those technologies that are found to be technically infeasible will not be considered further in the BACT analysis.

Good Combustion Practices

Good combustion practices to minimize incomplete combustion are inherent in the Wartsila design and control system. GCP is typically employed to operate the RICE at optimum design conditions. GCP is considered technically feasible.

Clean Fuel

Natural gas is available and feasible for use in the Project.

Add-On Controls

Add-on control devices [including fabric filtration, ESP, wet ESP (WESP), and wet scrubbers] are not technically feasible for the Wartsila engine because of exhaust conditions, fine particulate distribution, and inherently low uncontrolled PM emission rates. Consistent with this position and based on the information in EPA's RBLC database, no large gas-fired ICE has been equipped with an add-on control device.

4.2.2.4 Ranking of Technically Feasible Control Alternatives

GCP and the use of pipeline-quality natural gas are the only feasible PM control technologies for the Project. These technologies are compatible control strategies and, considered together, they present the best control option for minimizing PM. A ranking is therefore, not required to establish the top technology.

4.2.2.5 Evaluation of Economic, Environmental, and Energy Impacts of Feasible Technologies

The use of GCP and clean fuels are recognized to result in the lowest economic, environmental and energy impacts in reducing emissions of PM.

4.2.2.6 Selection of BACT and Rationale

Based on the identification and technical evaluation of the available control technologies, the proposed BACT for PM emissions from the Project is the work practice standard of using GCP and clean fuel (natural gas). The proposed BACT emissions limits are consistent with previous BACT emissions limits.

4.3 CO₂ BACT Evaluation

EPA issued guidance on the determination of BACT for GHGs (*"PSD and Title V Permitting Guidance for Greenhouse Gases,"* March 2011). EPA believes, in BACT reviews of GHGs, that the "top down" approach should be followed, but that it is important to consider options that improve the overall energy efficiency of the source or modification through technologies, processes, and practices at the emitting unit. In general, a more energy-efficient technology burns less fuel than a less energy-efficient technology on a per-unit-of-output basis. Thus, considering the most energy-efficient technologies in the BACT analysis helps reduce the products of combustion, which includes not only GHGs but other regulated New Source Review (NSR) pollutants (e.g., NO_x, SO₂, PM/PM₁₀/PM_{2.5}, CO, etc.). Thus, EPA emphasizes that energy efficiency should be considered in BACT determinations for all regulated NSR pollutants (not just GHGs).

The following subsections provide the BACT analysis for the Project.

4.3.1 Identification of Available Control Technologies

The first step in the top down BACT process is to identify all "available" control options. Available control options are those air pollution control technologies or techniques (including lower emitting processes and practices) that have the potential for practical application to the emissions unit and the regulated pollutant under evaluation.

EPA has placed potentially applicable control alternatives identified and evaluated in the BACT analysis into the following three categories:

- Inherently Lower Emitting Processes/Practices/Designs
- Add-On Controls
- Combinations of Inherently Lower Emitting Processes/Practices/Designs and Add-On Controls

EPA recommends that the BACT analysis should consider potentially applicable control techniques from all of the above three categories.

GHGs under EPA regulations are considered as a single air pollutant, which is the aggregate group of the six principal gases, CO₂, N₂O, CH₄, HFCs, PFCs, and SF₆. CO₂ emissions result from the oxidation of carbon in the fuel. CH₄ emissions result from incomplete combustion and N₂O emissions result primarily from the temperature of combustion. CO₂, N₂O, and CH₄ are the GHGs that will be emitted from the Project.

EPA recommends that permit applicants and permitting authorities should identify all “available” GHG control options that have the potential for practical application to the source under consideration. In its PSD and Title V Permitting Guidance for GHGs, EPA emphasizes two mitigation approaches for CO₂: 1) energy efficiency and 2) carbon capture and storage (CCS).

The GHG emissions from the Project will also include CH₄. However, any emissions of CH₄ will be minimized using an oxidation catalyst system.

Clean Fuels

The combustion of natural gas has the lowest emissions of GHGs of any fossil fuel and emits almost 30 percent less CO₂ than oil, and about 45 percent less CO₂ than coal (source: www.naturalgas.org). The fuel for the Wartsila engine will be natural gas. It is important to recognize that the definition of BACT in 40 CFR 52.21(b)(12) includes use of “clean fuels” as a pollution control technique. The EPA PSD and Title V Permitting Guidance for GHGs states that clean fuels which would reduce GHG emissions should be considered while recognizing at the same time that the BACT analysis does not need to include a clean fuel option that would fundamentally redefine the source. Therefore, the Project will utilize “clean fuels” as included in the definition for BACT in the CAA Part 169(3).

Energy Efficiency

Energy efficiency falls under the general category of lower polluting processes/practices. Applying technologies, measures and options that are energy efficient translates not only in the reduction of emissions of the particular regulated NSR air pollutant undergoing BACT review, but it also may achieve collateral reductions of emissions of other pollutants. There are different categories of energy efficient improvements:

- Technologies or processes that maximize the efficiency of the individual emissions unit
- Options that could reduce emissions by improving the utilization of thermal energy and electricity that is generated and used onsite

When the efficiency of the power generation process is increased, less fuel is burned to produce the same amount of electricity. This provides the benefits of lower fuel costs and reduced air pollutant emissions (including CO₂).

Carbon Capture and Storage (CCS)

CCS falls under the category of add-on controls, which are air pollution control technologies that remove pollutants from a facility's emissions stream. EPA suggests that CCS is an add-on pollution control technology that is "available" for large CO₂ emitting facilities including fossil fuel-fired power plants and industrial facilities with high purity CO₂ streams. As a result, EPA suggests that CCS be considered in Step 1 of the BACT analysis.

CCS is composed of three main components: CO₂ capture and/or compression, transport, and storage.

Carbon Capture – Before CO₂ gas can be sequestered, it must be captured as a relatively pure gas, so that it can be feasibly stored. Most power plants and other large point sources use air-fired combustors, a process that exhausts CO₂ diluted with nitrogen. Flue gas from natural gas contains only about five percent CO₂ by volume. For effective carbon sequestration, the CO₂ in the exhaust gases must be separated and concentrated due to the low percent by volume.

The most likely options currently identifiable for CO₂ separation and capture include:

- Absorption (chemical and physical)
- Adsorption (physical and chemical)
- Low temperature distillation
- Gas separation membranes
- Mineralization and biomineralization

Carbon Transport – After the CO₂ is captured, it must be transported to a carbon sequestration site. Pipelines are the most common method for transporting large quantities of CO₂ over long distances. Shipping CO₂ via pipeline involves compressing gaseous CO₂ to a pressure above 1,160 pounds per square inch (psi), to increase CO₂ density and make it easier and less expensive to transport. A CO₂ pipeline would be similar to a high pressure natural gas pipeline and is technically possible. CO₂ also can be transported as a liquid in seagoing vessels or via tankers on roads or railways. In these instances, the CO₂ is held in insulated tanks at low temperatures and relatively low pressures.

Carbon Storage – In a CCS system, CO₂ is captured, it is transported, if necessary, and then stored. Geologic formations such as depleted oil and gas reservoirs, unmineable coal seams, and underground saline formations are potential options for long-term storage. Pressurized CO₂ is injected into the deep geologic formations through drilled wells. Under high pressure, CO₂ turns to liquid and can move through a formation as a fluid. Once injected, the liquid CO₂ tends to be buoyant and will flow upward until it encounters a barrier of non-porous rock, which can trap the CO₂ and prevent further upward migration. When CO₂ is injected into a coal seam, it is adsorbed onto the coal surfaces, and methane gas is released and produced in adjacent wells. There are other mechanisms for CO₂ trapping as well: CO₂ molecules can dissolve in brine, react with minerals to form solid carbonates, or adsorb in the pores of the porous rock.

Deep saline formations, which are layers of porous rock saturated with brine, present an enormous potential for geologic storage of CO₂. However, there is not much experience with saline formations such as that acquired through resource recovery from oil and gas reservoirs and coal seams. There is ongoing research focused on storage in organic rich shale, which is a thin horizontal layer of sedimentary rock with low vertical permeability and in basalt formations, which are geologic formations of solidified lava. Other possible options include liquid storage in deep ocean areas.

Oxidation Catalyst

Catalytic oxidation technology, which is primarily designed to reduce CO emissions, will also reduce CH₄ emissions but to a lesser extent. Oxidation catalysts operate at elevated temperatures where excess O₂ in the exhaust reacts with CH₄ to form CO₂. As a result, 25 lb of CO₂e are reduced to 2.75 lb of CO₂. The project proposes the use of an oxidation catalyst to control CO and VOCs and is required to meet emission limits in 40 CFR Subpart ZZZZ. The oxidation catalyst will also minimize emission of CH₄.

4.3.2 Identification of Technically Feasible Control Alternatives

Under the second step of the top down BACT analysis, a potentially applicable control technique listed in Step 1 may be eliminated from further consideration if it is not technically feasible for the specific source under review. EPA considers a technology to be potentially applicable if it has been demonstrated in practice or is available.

Energy Efficiency

Efficient power generation is technically feasible and is being proposed for the Project. This is discussed in detail in Step 4.

CCS

In its PSD and Title V permitting guidance for GHGs, EPA states that it does not believe CCS will be a technically feasible BACT option in certain cases at this time. To establish that an option is technically feasible, the permitting record should show either that an available control option has been demonstrated in practice or is available and applicable, with the term “applicable” generally meaning a technology can reasonably be installed and operated on the source type under consideration. EPA recognizes the significant logistical hurdles that the installation and operation of a CCS system presents and that set it apart from other add-on controls that are typically used to reduce emissions of other regulated pollutants. In addition, other add-on controls typically have an existing accessible infrastructure in place to address waste disposal and other offsite needs. It should also be noted that while CCS may be available according to EPA, it is not “commercially available.” All current CCS projects for power plants are primarily in the demonstration stage.

Logistical hurdles for CCS may include obtaining contracts for offsite land acquisition (including the availability of land), the need for funding (including, for example, government subsidies), timing of available transportation infrastructure, developing a site for secure long-term storage and environmental permitting for underground GHG sequestration. Not every source has the resources to overcome the offsite logistical barriers necessary to apply CCS technology to its operations.

There are no CCS systems commercially available for full-scale power plants in the United States. On February 3, 2010, President Obama established an Interagency Task Force on Carbon Capture and Storage, composed of 14 Executive Departments and Federal Agencies. The Task Force delivered several recommendations to the President on August 12, 2010. The Task Force, co-chaired by the U.S. Department of Energy (DOE) and the EPA, recommended a comprehensive and coordinated strategy to overcome the barriers

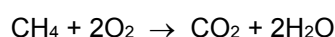
to the widespread, cost effective deployment of CCS within ten years, with a goal of bringing five to ten commercial demonstration projects online by 2016. These projects, to be deployed with the help of federal funding, are intended to demonstrate a range of current generation CCS technologies applied to coal-fired power plants and industrial facilities. The Task Force concluded that such research and development efforts were designed to reduce the cost of CCS and facilitate cost-effective deployment after 2020. However, widespread deployment of CCS will occur only if the technology is commercially available at economically competitive prices. Therefore, the application of CCS is very much in the development stage and not commercially available.

In November 2010, EPA published the final rule for Federal requirements of Underground Injection Control (UIC) for CO₂ Geologic Sequestration (GS) Wells, as authorized by the Safe Drinking Water Act (SDWA). The final rule establishes new federal requirements for the underground injection of CO₂ for the purpose of long-term underground storage, or GS, and a new well class – Class VI – to ensure the protection of underground sources of drinking water (USDWs) from injection-related activities. Therefore, authorization must be obtained from FDEP under this federally delegated program prior to GS. Permitting for a Class VI well takes many years as exploratory wells are likely required for CO₂ sequestration, including drilling deep holes, testing, etc., prior to approval of an injection well. Indeed, the exploratory well process to assess the formation can take over two years for drilling, testing, and approval of the start of an injection well process.

Based on these considerations, it can be reasonably concluded that CCS is not applicable to the Project, and consequently not technically or economically feasible.

Oxidation Catalyst

Catalytic oxidation is an available control technology for CH₄, although no approval for its use for this purpose has occurred. The oxidation catalyst will reduce CH₄ with the following reaction:



The addition of an oxidation catalyst for the control of CO and VOC emissions to the Project will reduce CH₄. While CH₄ emissions can be reduced using an oxidation catalyst, the amount of total CO₂e reduced is low and would not be a significant reduction compared to energy efficiency.

4.3.3 Ranking of Remaining Control Technologies

After the list of all available controls is narrowed down to a list of the technically feasible control technologies in Step 2 above, Step 3 of the top down BACT process calls for the remaining control technologies to be listed in order of overall control effectiveness for the regulated NSR pollutant under review. The most effective control alternative (i.e., the option that achieves the lowest emissions level) should be listed at the top and the remaining technologies ranked in descending order of control effectiveness.

Based on the discussion in Steps 1 and 2, the only technically feasible control option for GHGs is energy efficiency.

4.3.4 Economic, Energy, and Environmental Impacts

Under Step 4 of the top down BACT analysis, economic, energy, and environmental impacts must be evaluated for each option remaining under consideration.

The “top” control option and in the case of GHG the “top” energy reduction technology should be established as BACT unless the applicant demonstrates, and the permitting authority agrees, that the energy, environmental, or

economic impacts justify a conclusion that the most stringent technology is not “achievable” in that case. If the most stringent technology is eliminated in this fashion, then the next most stringent alternative is considered, and so on.

The “top” control option is energy efficiency and using natural gas. Natural gas has the lowest GHG emissions of any fossil fuel.

The efficiency of the generation technology in producing electricity in an amount necessary to meet demands and fuel utilized are the most important aspects in GHG emissions from electric generation projects. Together, efficiency, fuel type and operational dispatch/cycling dictate the amount of GHG emissions per unit of generation.

The measure of the efficiency for an electrical generating facility is the units’ heat rate. Heat rate is a measurement of how efficiently a unit uses heat energy. It is expressed as the number of British thermal units (Btu) of heat required to produce a kilowatt-hour of energy based on higher heat value (HHV). A heat rate of 3,413 Btu/kWh reflects an efficiency of 100 percent from thermal energy to electrical energy.

The proposed Wartsila units’ heat rate and energy efficiency were compared to data obtained from the U.S. Energy Information Administration (EIA). Based on data provided in the Annual Energy Review 2017, the approximate heat rate for electricity for fossil fueled power plants in the U.S. in 2015 was 9,127 Btu/kWh net (HHV) (37.4 percent efficiency) (EIA 2016; Table 3.1a and 8.1).

Based on US EIA’s annual review of the electrical power industry, the reported average net heat rate (HHV) for natural gas firing was 7,870 Btu/kWh net (HHV) (43.4 percent efficiency) including all types of generation (EIA 2017 Table 8.1). Of the generation types, the average tested heat rates when firing natural gas are (EIA 2017 Table 8.2):

- Steam turbine generator – 10,382 Btu/kWh (HHV-net) (32.9 percent efficiency),
- Natural gas turbine – 11,214 Btu/kWh (HHV-net) (30.4 percent efficiency),
- Internal combustion – 9,179 Btu/kWh (HHV-net) (37.2 percent efficiency), and
- Combined cycle – 7,652 Btu/kWh (HHV-net) (44.6 percent efficiency).

The average base heat rate of a Wartsila 18V50SG engine is 8,168 Btu/kWh (HHV) based on average ambient air temperature of 105°F (41.8 percent efficiency).

As part of EPA’s clean energy initiatives, EPA developed the Emissions and Generation Resource Integrated Database (eGRID) as a resource tool in assessing GHG emissions. eGrid is a comprehensive source of data on the environmental characteristics of almost all electric power generated in the United States with data available based on a variety of geographic regions and locations. Data is also available for units, plants, power control areas (system), states, National Electric Reliability Council (NERC) regions and sub regions, and the U.S. Based on the latest available eGrid data, the following are the emissions of CO₂ on a generation basis for generation facilities located in the same sub region as the project (2/27/17 data: <https://www.epa.gov/energy/emissions-generation-resource-integrated-database-eGRID>; gross heat rate as HHV):

- Florida – 1,024 lb CO₂/MWh gross (HHV) for all generation (including nuclear); and
- Florida - 1,170 lb CO₂/MWh for total combustion generation.

The Wartsila Model 18V50SG gas engine also has advantages over other generation options such as gas turbines. The heat rate for the Wartsila engine does not change with ambient temperature and remains relatively constant over the load range.

When firing natural gas, the GHG emissions for the Wartsila 18V50SG at baseload, and new and clean condition is expected to be 972 lb CO₂/MWh (gross, HHV) based on an average an average base heat rate of 8,168 Btu/kWh (gross, HHV) and ambient air temperature of 105°F. The heat rate for the Wartsila engine is about 29 percent lower than the heat rate for Unit 1 that averaged about 11,500 Btu/kWh based on EPA Acid Rain Database for the years 2013 through 2017.

4.3.4.1 Selection of BACT

In Step 5 of the BACT determination process, the most effective control option not eliminated in Step 4 should be selected as BACT for the pollutant and emissions unit under review and included in the permit.

Energy efficiency, the only remaining and feasible control technology, is selected as BACT for the GHG emissions from the Project. Energy efficiency plays a major role in affecting GHG emissions and EPA suggests that more emphasis will be given to energy efficiency in GHG BACT analysis. As demonstrated in the discussion in Step 4, the Project meets the requirements of energy efficiency under EPA's GHG BACT guidelines.

The CCS option was eliminated in Step 2 as not technically feasible for the Project. Although EPA considers CCS as available, it is not commercially available. Indeed, EPA recognizes that at present CCS is an expensive technology, largely because of the costs associated with CO₂ capture and compression as supported by EPA's recent GHG NSPS for electric utility units. In the Guidance, EPA states that even if not eliminated in Step 2 of the BACT analysis, on the basis of the current costs of CCS, CCS would be eliminated from consideration in Step 4 of the BACT analysis, even in some cases where underground storage of the captured CO₂ near the power plant is feasible. In the case of the Project, CCS is not a technically or economically feasible control technology based on the current status of this technology.

The proposed BACT for GHG is 1,110 lb CO₂e/MWh (Gross Output) based the range of operating conditions and performance and degradation margins. The performance is based on data provided by Wartsila over the operating range of 100 percent, 70 percent and 40 percent load.

Category	Units	Estimated Performance		
Fuel		Gas	Gas	Gas
Temperature	degree F	105	105	105
Gross Load	%	100%	70%	40%
Gross Heat Rate	Btu/kWh (HHV)	8,168	8,587	9,413
Gross Efficiency	%	41.8%	39.7%	36.3%
CO ₂ e	lb CO ₂ e/MWh	972	1,022	1,120
Operation		33%	33%	33%
Gas Average CO ₂ e	lb CO ₂ e/MWh	1,038	(Average of 100%, 70% and 50% load)	

Category	Units	Estimated Performance	
Performance and Engine Margin	%	2%	(Startup Margin and engine differences)
Degradation Margin	%	5%	(Account for normal wear during operation)
Proposed CO ₂ e	lb CO ₂ e/Mwh	1,110	12-month Rolling Average (Gross Output)

The proposed BACT is similar to the STEC Red Gate Power Project that consisted of 12 Wartsila 18V50SG engines. EPA Region 6 established a BACT limit of 1,145 lb/MWh on a 12-month rolling basis (PSD-TX-1322-GHG). In responding to public comment on the issuance of this permit, EPA determined that the Wartsila engines “are more energy efficient and lower GHG-emitting than simple cycle turbines”. EPA also determined “that the proposed RICE can achieve an output based BACT limit of 1,145 lb of CO₂/MWh (gross) during all hours of operation including startups and shutdowns” and “operate at times with an operating range load as low as 40% of the total plant, but has also indicated they may be required to turndown generation to as little as 10MW to the grid (a little less than 5% of full load capability of the proposed plant).” This operation profile is similar to that proposed for this Project. While the Wartsila engine are less efficient than a combined cycle unit, EPA found that combined cycle units “generally cannot maintain high thermal efficiency over the load curve range.” Moreover, with regard to Wartsila engines, EPA found that “from an efficiency perspective, the proposed RICE have the highest efficiency over the proposed operating load range and also meet the turndown requirements for the plant.” (See South Texas Electric Cooperative, Inc. – Red Gate Power Plant Prevention of Significant Deterioration Permit for Greenhouse Gas Emissions PSD-TX-1322-GHG, Response to Public Comments, U.S. Environmental Protection Agency, February 2015.) The project was also approved for an equivalent of 5,650 hours per year per engine, much higher than simple cycle CT.

EPA’s RACT/BACT/LAER Clearinghouse (RBLC) was also reviewed for determinations of BACT for GHGs from large natural gas fired RICE (>500 hp) (see Table 4-3). While the majority of the projects are for emergency generators, large natural gas compressor engines are similar to the operating requirements of the Project (fast start, consistent power over the load range and long periods of continuous operation). These BACT determinations establish CO₂e emissions and efficiency limits for the horsepower produced by the engines since no electric power is produced. A summary of the determinations in the RBLC are contained below and compared to the proposed BACT limit for the Project:

- Cameron Interstate Pipeline LLC. (RBLC ID: LA-0292) – 12 - 5,000 hp Waukesha 16V-27GL compressor engines. BACT equivalent to 0.97 lb CO₂e/hp-hr. Project’s Wartsila Engines: 0.78 lb CO₂e/hp.
- Nuevo Midstream LLC. (RBLC ID: TX-0746) – 5 – 3,500 hp Caterpillar G3612LE compressor engines. BACT equivalent to 585 g CO₂e/hp-hr. Project’s Wartsila Engines: 352 g CO₂e/hp.
- Markwest Buffalo Creek Gas Co LLC. (RBLC ID: OK-0148) – 1,775 hp compressor engines. BACT equivalent to 7,900 Btu/hp-hr. Project’s Wartsila Engines: 6,091 BTU/hp-hr.
- Atlas Pipeline Midcontinent Westok, LLC. (RBLC ID: OK-0142) – 3 – 3,500 hp Caterpillar G3612LE compressor engines. BACT equivalent to 7,116 Btu/hp-hr. Project’s Wartsila Engines: 6,091 BTU/hp-hr.

The Project's proposed use of the Wartsila 18V50SG natural gas fired RICE engine is clearly more efficient with lower CO₂ emissions per engine hp than the large natural gas RICE in EPA's RBLC. It is also noted that the proposed BACT for the Project is about 20 percent lower than the GHG BACT limit of 1,372 lb CO₂e/MWh established for Lauderdale Peaker Project that uses General Electric's most efficient 200 MW+ simple cycle 7F.05 combustion turbines (FDEP Project 0110037-013-AC/PSD-FL-423A).

5.0 AMBIENT MONITORING ANALYSIS

Based on the net emission changes from the proposed Project (see Table 2-5), pre-construction ambient monitoring analyses for PM₁₀, PM_{2.5}, and O₃ (based on NO_x or VOC emissions) may be required as part of the PSD application. Ambient monitoring analyses are not required if it can be demonstrated that the Project's maximum air quality impacts will not exceed the PSD significant monitoring concentrations (SMC) and, for O₃, the Project's potential emissions will not exceed 100 TPY of NO_x or VOC emissions.

Maximum impacts due to the Project only are predicted to be below the SMC for PM₁₀ and PM_{2.5} (refer to Table 6-4). As a result, a pre-construction ambient monitoring analysis is not required for these pollutants as part of the application, except for PM_{2.5}, due to a recent ruling by the U.S. Court of Appeals (see the following paragraphs). For O₃, the Project's VOC emissions are less than 100 TPY. Therefore, pre-construction ambient monitoring analysis is not required for O₃.

For PM_{2.5}, on January 22, 2013, the US Court of Appeals vacated the parts of the two PSD rules (40 CFR 51.166 and 40 CFR 52.21) establishing an SMC, finding that EPA was precluded from using the PM_{2.5} SMC to exempt permit applicants from the statutory requirement to compile preconstruction monitoring data. As a result, permitting of new or modified sources requires submittal of monitoring data prior to construction regardless of the source's impact. As a result, PM_{2.5} concentrations from a representative monitor must be submitted as part of the PSD permit application because the Project's PM_{2.5} emissions are greater than the SER.

Based on the impacts of PM₁₀ being less than the SMC an exemption from the pre-construction monitoring requirement is applicable pursuant to Rule 62-212.400(3)(e), F.A.C. In addition, ambient PM_{2.5} monitoring data collected by FDEP at monitoring stations near the Project are considered to be representative of air quality in the Project's vicinity. These data are being used to satisfy the pre-construction monitoring requirement for PM_{2.5}.

Air quality monitoring data concentrations for PM₁₀ and PM_{2.5} were obtained from the following stations:

- 24-Hour and annual average PM_{2.5} – Leon County monitor, Tallahassee - Florida (Site ID# 012-073-0012)
- 24-Hour average PM₁₀ – Okaloosa County monitor, Fort Walton Beach - Florida (Site ID# 091-121-0002))

Data collected in these stations from 2015 through 2017 for PM₁₀ and PM_{2.5} are presented in Table 5-1.

These data indicate that the design air quality concentrations measured in the area are below the applicable PM₁₀ and PM_{2.5} ambient air quality standards.

6.0 AIR QUALITY IMPACT ANALYSIS

This section addresses the predicted air quality impacts of regulated air pollutants due to the addition of five 18.82 MW Wartsila 18V50SL engines at the existing City of Tallahassee Hopkins site. This analysis accounts for the impact of four engines that were originally permitted in 2017 plus one additional engine subsequently requested in

this application by City of Tallahassee. Because of the first four engines were permitted in 2017 and are currently under construction, this analysis evaluates the potential impacts for all five engines. The four engines are being constructed in the space where two Westinghouse combustion turbines (referred to as CT-1 and CT-2) were located (see Figure 1-1). The proposed fifth engine will be located east of the four engines (see Figure 1-1). In addition to the previous retirement of CT-1 and CT-2, Boiler Unit No. 1 will be retired with the current Project. The general modeling approach followed the latest EPA and FDEP modeling guidelines for predicting air quality impacts for regulated pollutants.

Based on the potential emissions of the Project, the Project's emissions are greater than the PSD SERs for PM/PM₁₀/PM_{2.5}, and VOC. As such, an air quality impact analysis is required for these pollutants under FDEP's PSD regulations. There is however no ambient air quality standards for PM or VOC and therefore, air quality analysis was performed for PM₁₀ and PM_{2.5}.

The following sections present a summary of the modeling methodology for the air quality impact analyses for the Project and the air impact results.

6.1 Air Modeling Analysis Approach – Site Vicinity

Model Selection

The selection of air quality models to calculate air quality impacts for the proposed project must be based on the models' ability to simulate impacts in the vicinity of the facility. The latest version of the American Meteorological Society and EPA Regulatory Model (AERMOD) dispersion model was used to evaluate the pollutant impacts due to the proposed project. AERMOD (Version 18081) is available on the EPA's Internet web site, Support Center for Regulatory Air Models (SCRAM), within the Technology Transfer Network (TTN). The EPA and FDEP recommend that AERMOD be used to predict pollutant concentrations at receptors located within 50 km of a source. AERMOD calculates hourly concentrations based on hourly meteorological data. AERMOD is applicable for the type of Project sources and area in which the Project is located since it is recognized as containing the latest scientific algorithms for simulating plume behavior in all types of terrain.

AERMOD was used to predict the maximum pollutant concentrations due to the Project at nearby areas surrounding the facility.

For modeling analyses that will undergo regulatory review, such as determining compliance with NAAQS, the following model features are recommended by EPA for rural mode and are referred to as the regulatory default options in AERMOD:

1. Final plume rise at all receptor locations
2. Stack tip downwash
3. Buoyancy induced dispersion
4. Default wind speed profile coefficients for rural mode
5. Default vertical potential temperature gradients
6. Calm wind processing

The EPA regulatory default options were used to address maximum impacts.

Project Sources

Air quality analyses were performed to assess the maximum impacts of the five 18.82 MW Wartsila engines. Summaries of the criteria pollutant emission rates, physical stack and stack operating parameters for the proposed engines are presented in Section 2.0 for natural gas-firing. In both the near-field and far-field (i.e., Class I) analyses, air quality impacts were predicted for a range of three possible operating loads: 100 percent, 70 percent, and 40 percent. Summaries of the criteria pollutant emission rates, physical stack and stack operating parameters for the proposed engines used in the air modeling analyses are presented in Table 2-1, Section 2. The new engines will each have stack heights of 75 ft and inner diameters of 5.3 ft.

Building Downwash Effects

Building downwash effects from existing and proposed structures in the vicinity of the proposed engines were included in the modeling analysis. A summary of all existing and proposed structures at the Hopkins plant is presented in Table 6-1. All structures were processed with EPA Building Profile Input Program [(BPIP), Version 04274] to determine direction specific structure heights and widths for each 10-degree azimuth direction for each source that was included in the modeling analysis. For cumulative source impact assessments building downwash was included in the modeling analysis for the existing sources at Hopkins.

Meteorological Data

Meteorological data used in AERMOD to estimate air quality impacts consisted of a concurrent 5-year period of hourly surface weather observations and upper air sounding data collected from the National Weather Service (NWS) station located at Tallahassee International Airport (TLH/TAE). The 5-year period of the meteorological data was from 2013 through 2017 and was prepared by the FDEP using AERMET Version 16216. AERMINUTE Version 15272 was used by FDEP to process 1-minute wind data collected by the automatic surface observing system (ASOS) into hourly averages of wind direction and wind speed. A minimum wind speed threshold of 0.5 meters per second (m/s) was used. The ASOS station at the TLH airport is located approximately 7.5 km (4.7 miles) southeast of the Project site with the terrain between the site being mostly flat. A comparison of the annual average land use parameters between the TLH ASOS station and the project site was performed using AERSURFACE Version 13016 and is as follows:

Location	Albedo	Bowen Ratio	Surface Roughness
TLH ASOS	0.15	0.64	0.064
Project Site	0.15	0.52	0.393

Based on the above review, the meteorological data collected from the TLH ASOS site were selected for use in the modeling analyses.

Receptor Locations

For the near-field modeling analysis, a Cartesian grid was used to predict concentrations on and beyond the Hopkins restructured property boundary out to 5 km. Receptors were located at the following intervals and distances from the Project:

- Along the Plants' restricted property boundary – 50 meters
- Beyond the restricted property boundary out to 2 km – 100 meters

- From 2 km to 5 km – 250 meters

More than 3,000 receptors were used to estimate the maximum concentrations predicted for the Project. Figure 6-1 shows the location of the receptor grid.

For the far-field modeling analysis, receptors have been developed by the Federal Land Managers (FLM) to represent the boundary and internal areas of each nearby PSD Class I area. For predicting air quality impacts at the Bradwell Bay NWA and Saint Marks NWA, the analysis used the FLM's 125 and 101 receptors that were developed for those two respective Class I areas. Initially, a Class I screening analysis was performed with an array of receptors located at 1-degree intervals and at a distance of 50 km from the proposed Project site.

Significant Impact Analysis

A significant impact analysis is performed to determine the maximum air quality impact due to projected emissions increases. If the highest predicted impact for a particular pollutant and averaging time exceeds the respective PSD Class II significant impact level (SIL), more detailed modeling analyses are required for that pollutant and averaging time to address compliance with the NAAQS and, if applicable, the allowable PSD increment.

For the proposed project, SIL analyses were performed for the following pollutants and averaging times:

- PM₁₀: 24-hour and annual averages
- PM_{2.5}: 24-hour and annual averages

Initially, a load analysis was performed using vendor information to determine the worst-case operating load for the 4 engines in the site vicinity. The evaluated operating loads were as follows:

- 100 percent
- 70 percent
- 40 percent

The engine load that resulted in the highest impacts was used in any further modeling efforts to determine compliance with the NAAQS or allowable PSD Class II increments. The SIL analyses for the 24-hour and annual PM_{2.5} concentrations are based on the maximum 5-year average concentrations predicted using 5 years of representative meteorological data. The SIL analyses for the 24-hour PM₁₀ concentration is based on the maximum predicted concentration over the 5-year period. The SIL analyses for the annual average PM₁₀ concentration is based on the maximum predicted concentration for any year over the 5-year period.

It should be noted that in January 2013, the PM_{2.5} SIL under 40 CFR 51.166(k)(2) and 40 CFR 52.21(k)(2) were vacated and remanded the portions of EPA's rule regarding the SIL to exempt sources from cumulative source modeling [*Sierra Club v. EPA*, 705 F.3d 458 (D.C. Circuit 2013)]. On March 4, 2013, EPA issued *Draft Guidance for PM_{2.5} Permit Modeling* (Stephen D. Page, Director, OAQPS) that provided preliminary recommendations describing how a stationary source seeking a PSD permit can demonstrate that it will not cause or contribute to a violation of the NAAQS and PSD increments. According to the EPA's draft guidance, with additional justification, the permitting authority may use the same PM_{2.5} SILs that were vacated to demonstrate that a full cumulative source impact analysis is not needed.

Based on the results of the significant impact analysis, 24-hour PM₁₀ and the 24-hour and annual PM_{2.5} concentrations were predicted to exceed the SIL. As such, additional cumulative source analyses are required to demonstrate compliance with the 24-hour PM₁₀ NAAQS and allowable PSD Class II increment and with the 24-hour and annual PM_{2.5} NAAQS and allowable PSD Class II increments.

Secondary PM_{2.5} and O₃ Formation

Secondary PM_{2.5}

NO_x and SO₂ emissions are precursors to secondary PM_{2.5} formation in the atmosphere. EPA has developed a two-tiered demonstration approach for addressing single-source impacts on secondary PM_{2.5}. The Tier 1 demonstration involves use of technically credible relationships between emissions and ambient impacts based on existing modeling studies and the Tier 2 demonstration involves case-specific application of chemical transport modeling (e.g., with a Eulerian grid or Lagrangian model). As part of the latest air quality modeling guidelines (Appendix W, effective February 16, 2017) EPA has developed a Tier 1 demonstration tool for PM_{2.5} precursors called Modeled Emission Rates for Precursors (MERPs). A MERP represents a level of increased precursor emissions that is not expected to contribute to levels of ambient PM_{2.5} concentrations in order to determine causes or contributions to a violation of the NAAQS for PM_{2.5}. A finding that projected increases in the PM_{2.5} precursor emissions of NO_x and SO₂ from a proposed project are below the respective MERPs could be part of a sufficient demonstration that the construction will not cause or contribute to a violation of the appropriate NAAQS. Where project sources emit multiple precursors, the sum of precursor impacts would need to be considered for a sufficient demonstration of compliance. Also, if a project's sources emit both primary PM_{2.5} and precursors of secondary PM_{2.5}, EPA requires a combination of the primary and secondary impacts to determine total PM_{2.5} impacts as part of the PSD compliance demonstration.

On December 2, 2016, EPA published their original guidance on the use of MERPs. EPA has performed regional scale modeling and developed MERPs for eastern, central, and western regions of the US using the following equation:

$$\text{MERP (annual emission rate)} = \text{Critical Air Quality Threshold} * (\text{Modeled emission rate from hypothetical source} / \text{Modeled air quality impact from hypothetical source})$$

On February 23, 2017, EPA published an errata memorandum which corrected an error in the original guidance. For the eastern US, the most conservative (lowest) SO₂ and NO_x MERP values for impacts on daily PM emissions are 628 tons/yr and 2,295 tons/yr, respectively. Similarly, the lowest SO₂ and NO_x MERP values for impacts on annual PM impacts are 4,013 tons/yr and 10,144 tons/yr, respectively.

According to EPA guidance, the maximum secondary PM_{2.5} impact from the NO_x and SO₂ emissions for the proposed Project can be estimated as follows:

- Maximum 24-hour average secondary PM_{2.5} impact in µg/m³ = [NO_x (TPY) from the Project/NO_x daily PM_{2.5} MERP (TPY) + (SO₂ (TPY) from source/SO₂ daily PM_{2.5} MERP (TPY))] x screening threshold concentration = [53.4 TPY/2295 TPY + 18.2 TPY/628 TPY] x 1.2 µg/m³ = 0.063 µg/m³
- Maximum annual average secondary PM_{2.5} impact in µg/m³ = [NO_x (TPY) from the Project/NO_x daily PM_{2.5} MERP (TPY) + (SO₂ (TPY) from source/SO₂ daily PM_{2.5} MERP (TPY))] x screening threshold concentration = [53.4 TPY/10144 TPY + 18.2 TPY/4013 TPY] x 0.2 µg/m³ = 0.002 µg/m³

The total PM_{2.5} impacts were determined after adding the primary PM_{2.5} impacts due to the primary PM_{2.5} emissions:

- Maximum 24-hour average total PM_{2.5} impact in $\mu\text{g}/\text{m}^3$ = Primary impact + Secondary impact = $2.75 \mu\text{g}/\text{m}^3 + 0.063 \mu\text{g}/\text{m}^3 = 2.81 \mu\text{g}/\text{m}^3$
- Maximum annual average total PM_{2.5} impact in $\mu\text{g}/\text{m}^3$ = Primary impact + Secondary impact = $0.37 \mu\text{g}/\text{m}^3 + 0.002 \mu\text{g}/\text{m}^3 = 0.037 \mu\text{g}/\text{m}^3$

The addition of secondary PM_{2.5} emissions marginally increased the distance of the proposed Project's significant impact for 24-hour PM_{2.5}, while the annual increase in distance was negligible.

Secondary O₃

NO_x and VOC emissions are precursors to secondary O₃ formation in the atmosphere. From the 2017 EPA memorandum, the maximum secondary O₃ impact due to the proposed project is calculated as follows:

Maximum 8-hour average secondary O₃ impact in ppb = [NO_x (TPY) from the Project/NO_x MERP (8-hr Ozone) + (VOC (TPY) from source/VOC MERP] x screening threshold concentration = $[53.4 \text{ TPY}/170 \text{ TPY} + 107.748 \text{ TPY}/1159 \text{ TPY}] \times 1.0 \text{ ppb} = 0.407 \text{ ppb}$

Since the maximum secondary O₃ impact is less than the SIL of 1.0 ppb, the increase is negligible.

Background PM_{2.5} Emission Sources

Based on the results of the significant impact analysis, an inventory of background PM emission sources located within 52 km from the Hopkins plant was requested from FDEP. Additionally, the Georgia Department of Natural Resources Environmental Protection Division was contacted and a list of facilities located in nearby Seminole, Decatur and Grady Counties was obtained. Figure 6-2 shows the location of the nearest PM background source relative to the proposed Project's significant impact area (SIA) as indicated by circles. Figure 6-2 presents any source near to the Hopkins Plant. Figure 6-3 shows a far-view image showing all background PM sources considered in the analysis. A facility screening analysis was performed based on recommended modeling guidance. All facilities that were located within the SIA were automatically included in the modeling analysis. Facilities that were located outside the SIA were evaluated using the 20D approach. Using this technique, facilities whose annual emissions are greater than 20D-S, where D is the distance in km from the facility to the Project site and S is the Project's significant impact distance, were included in the modeling analysis.

The results of the facility screening analysis are provided in Table 6-2 and indicate that the only background sources that need to be considered for the cumulative modeling analyses are the existing Hopkins plant sources (i.e., Units 2A, HC-3 and HC-4). Unit 1 was not included in the modeling analysis as it is to be retired with the proposed Project. The maximum emissions and stack parameters for each background Hopkins source are shown in Table 6-3. The NAAQS modeling analyses includes the proposed engines, the existing Hopkins sources and a non-modeled background concentration obtained from FDEP to obtain a total concentration that will be compared directly to the applicable NAAQS.

For PM_{2.5} the major-source baseline date is October 2010, and the only new emission sources at Hopkins since that date are the proposed five engines. As such, the impacts from the proposed engines were directly compared to the applicable PSD Class II increment.

For PM₁₀, the major source baseline date is 1975 and the five engines and existing Hopkins plant sources presented in Table 6-3 consume increment.

The following concentration ranks were used for determining air compliance from cumulative modeling analyses:

- NAAQS – for 24-hour PM_{2.5}: highest 8th highest 24-hour concentration, 5-year average; for PM₁₀: highest, 6th-highest 24-hour concentration over the 5-year period.
- PSD Increment – 24-hour PM₁₀ and PM_{2.5}: highest 2nd highest concentration in any year over the 5-year period and annual PM_{2.5} based on the highest concentration in any year over the 5-year period.

Non-Modeled Background Concentration

Background concentrations are necessary to determine total ambient air quality impacts to demonstrate compliance with the NAAQS. “Background concentrations” are defined as concentrations due to sources other than those specifically included in the modeling analysis. For all pollutants, the background concentration would include other point and fugitive emission sources not included in the modeling and natural background sources. In general, monitoring data collected near the area in which the air quality impact is performed is used for this purpose.

Based on FDEP recommendations, the background data using in the evaluation are:

- 24-Hour average PM_{2.5} – 17 µg/m³
- Annual average PM_{2.5} – 7.4 µg/m³
- 24-Hour average PM₁₀ – 60 µg/m³

These concentrations are representative of the Tallahassee area and are based on years 2015 to 2017. These background concentration were used for the NAAQS modeling analysis.

Modeling Results

Load/Significant Analysis

Table 6-4 presents the predicted maximum project-only impacts due to five engines as compared to the significant impact levels. Based on the results presented in Table 6-4, the proposed project’s maximum impacts are predicted to be greater than the SIL for 24-hour and annual PM_{2.5} and 24-hour PM₁₀ concentrations. As such, cumulative source modeling analyses are required to determine compliance with the 24-hour and annual PM_{2.5} and PM₁₀ NAAQS and allowable PSD Class II increments. The worst-case impacts occur during 40-percent load operation and the distance of significance is 1.56 and 0.38 kms, respectively, for PM_{2.5} and PM₁₀.

NAAQS Analysis

The results of the NAAQS analysis are presented in Table 6-5. For PM₁₀, the predicted maximum impact is 3.8 µg/m³ which when added to a background of 60 µg/m³ results in a total concentration of 63.8 µg/m³ which is less than the NAAQS of 150 µg/m³. For PM_{2.5}, the predicted maximum annual and 24-hour impacts are 0.5 and 2.3 µg/m³, respectively. When added to background concentrations, the total concentrations are 7.9 and 19.3 µg/m³, which are less than the respective NAAQS of 12 and 35 µg/m³.

PSD Class II Increment Analysis

The results of the PSD Class II increment analysis are summarized in Table 6-6. For PM₁₀, the predicted maximum impact is 5.17 µg/m³ which is less than the allowable 24-hour PM₁₀₅ increment of 30 µg/m³. For PM_{2.5}, the predicted maximum annual and 24-hour impacts are 0.44 and 4.70 µg/m³, respectively, which are less than the allowable increments of 4 and 9 µg/m³.

6.2 Air Modeling Analysis Approach – Far-Field Assessment

Model Selection and General Assumptions

A far-field impact assessment is required if the Project is located within 200 km from a PSD Class I area. The nearest PSD Class I areas to the Project site and their minimum distances (in km) are:

- Bradwell Bay National Wilderness Area (NWA) – 28.2
- Saint Marks NWA – 38.6
- Okefenokee (GA) NWA – 182.7, and
- Chassahowitzka NWA – 249.3

Based on the distances from the Project site to each Class I area, concentrations were predicted at the Bradwell Bay, Saint Marks and Okefenokee NWAs. The Bradwell Bay NWA lies entirely within 50 km from the project site. The Saint Marks NWA is mostly located within 50-km but has a small section extending out to 58 km from the project site.

AQRV Impact Requirements

The 2010 FLAG Report recommends a screening approach to exempt projects that are beyond 50 km from PSD Class I areas from AQRV impact review based on its annual emissions and distance from a Class I area. A project is considered to have negligible impacts on Class I area AQRVs if the total annual emissions of SO₂, NO_x, PM₁₀, and SAM (Q, in TPY, based on 24-hour maximum allowable emissions), divided by the distance from the Class I area (D, in km), Q/D, is 10 or less. Considering only the proposed five engines (and not the retirement of Boiler 1) the maximum annualized emissions for the proposed Project are (in TPY) as follows: PM₁₀: 69.4; SO₂: 18.2; NO_x: 53.4; and SAM: 2.8.

The FLM does not require AQRV impacts to be performed at the Bradwell Bay NWA. Alternatively, AQRV impacts are automatically required at the sections of Saint Marks that are located within 50 km from the Project site because the Q/D screening approach does not apply to Class I areas located within 50 km. However, for sections of the Saint Marks NWA that are beyond 50 km, Q/D is $(143.8 / 50) = 2.9$ and AQRV impacts are not required for that section of the NWA. Similarly, Q/D for the Okefenokee NWA is $(143.8 / 182.7) = 0.79$ and AQRV impacts are not required for that PSD Class I area.

The PSD applicability for the proposed project is summarized in Table 2-5 and indicates that the proposed emission increases for both sulfur dioxide and nitrogen oxides are less than the SER. As a result, annual sulfur and annual nitrogen deposition impacts at Class I areas are not required.

The following summarizes the AQRV requirements for the PSD Class I areas nearest to the proposed project site:

- Bradwell Bay NWA: FLM does not require AQRV impacts for this area.

- St Marks NWA: Within 50 km, impacts are required for 24-hour visibility impairment only. Beyond 50 km, no AQRV impacts are required by Q/D exemption.
- Okefenokee NWA: No AQRV impacts are required by Q/D exemption.

Class I Significant Impact Analysis

Significant impact analyses were performed to assess the proposed Project's maximum impacts at the PSD Class I areas. The maximum predicted PM₁₀ and PM_{2.5} concentrations due to the Project were compared to EPA's proposed PSD Class I significant impact levels. If the Project's impacts exceed the proposed EPA PSD Class I significant impact level for a specific pollutant and averaging time, then a more detailed analysis is required to determine compliance with the allowable PSD Class I increment. The proposed PSD Class I SILs are:

- PM₁₀: 24-hour – 0.3 µg/m³, annual – 0.2 µg/m³
- PM_{2.5}: 24-hour – 0.27 µg/m³, annual – 0.05 µg/m³

AERMOD was used to predict concentrations at the Class I areas using the same 5-year meteorological data record that was used for the near-field impact assessment. For Class I areas that are located beyond 50 km from the Project, current EPA guidance permits the use of AERMOD with a ring of 360 receptors, spaced at 1-degree intervals at a distance of 50 km from the project site. For this analysis, to be conservative, the elevations all receptors were set to the elevation of the Project site (i.e., 41 m).

Similar to the Class II analysis, a MERP analysis was performed to determine the maximum secondary PM_{2.5} impacts for the Class I areas. The analysis was performed using the Class I PM_{2.5} SIL values and the same NO_x and SO₂ MERP factors that were used in the Class II SIL analysis. The secondary impacts were then added to the maximum primary PM_{2.5} impacts to determine a total PM_{2.5} impact that was directly compared to the Class I SIL.

If the highest PM₁₀ or PM_{2.5} concentrations are predicted to be less than the significant impact levels, no additional modeling is required to address Class I impacts. If the maximum predicted concentrations from the AERMOD analyses are greater than one or more PSD Class I SILs, a more refined Class I analysis can be performed using the California Puff (CALPUFF, Version 5.8.5) modeling system. For the proposed Project the use of CALPUFF to refine the results of the significant impacts screening analysis was not required.

Project Information

For the far-field analysis, the proposed engines were evaluated for the same three operating loads (i.e., 100, 70 and 40 percent) as was assumed for the near-field modeling analyses.

Receptor Locations

For predicting air quality impacts at the Bradwell Bay NWA and Saint Marks NWA, the analysis used the FLM's 125 and 101 receptors that were developed for those two respective Class I areas. A ring of 360 receptors, spaced at 1-degree intervals and at a distance of 50 km from the proposed project, was used for all Class I areas that are located beyond 50 km from the proposed project site.

Class I Significant Impact Analysis Results

The results of the PSD Class I significant impact analysis are summarized in Table 6-7. The results indicate that the proposed project's maximum predicted impacts will be less than the Class I SIL at all evaluated PSD Class I

areas. As such, further analyses to demonstrate compliance with the allowable PSD Class I increments are not required at these areas.

7.0 ADDITIONAL IMPACT ANALYSIS

This section presents the impacts that the Project and general commercial, residential, industrial and other growth associated with the Project will have on vegetation, soils, and visibility in the vicinity of the site and impacts at the PSD Class I areas related to AQRVs. Specifically, this section addresses FDEP Rules 62-212.400(4)(e), (8)(a) and (b), and (9), F.A.C. These rules are:

(4) Source Information.

(e) The air quality impacts, and the nature and extent of any or all general commercial, residential, industrial, and other growth which has occurred since August 7, 1977, in the area the source or modification would affect.

(8) Additional Impact Analyses.

(a) The owner or operator shall provide an analysis of the impairment to visibility, soils and vegetation that would occur as a result of the source or modification and general commercial, residential, industrial and other growth associated with the source or modification. The owner or operator need not provide an analysis of the impact on vegetation having no significant commercial or recreational value.

(b) The owner or operator shall provide an analysis of the air quality impact projected for the area as a result of general commercial, residential, industrial and other growth associated with the source or modification.

(9) Sources Impacting Federal Class I Areas. Sources impacting Federal Class I areas are subject to the additional requirements provided in 40 CFR 52.21(p), adopted by reference in Rule 62-204.800, F.A.C.

7.1 Potential Impacts Due to Associated Growth

7.1.1 Impacts of Associated Growth

Construction of the proposed Project will occur over approximately 12 to 18 months and will require an average no more than 200 workers during that time. It is anticipated that many of these construction personnel will commute to the site. However, no additional permanent workers will be employed for the operation of the facility. The workforce needed to construct and operate the facility represents a small fraction of the population already present in the immediate area. Therefore, while there would be a small increase in vehicular traffic in the area, the effect on air quality levels would be minimal.

There are also expected to be no air quality impacts due to associated commercial and industrial growth since the Project is replacing existing capacity. The existing commercial and industrial infrastructure is adequate to provide any support services that facility might require and would not increase with the operation of the facility.

As demonstrated in Section 6.0, the maximum air quality impacts resulting from the proposed engine Project are predicted to be low and below the significant impact levels for all but the 24-hour PM_{2.5} concentrations. The predicted cumulative source 24-hour PM_{2.5} impacts demonstrate that the City of Tallahassee Hopkins plant and background sources will comply with the NAAQS. The retirement of Unit 1 operation as well as the removal of CT1 and CT2 are expected to improve air quality in the vicinity of the Hopkins Plant.

7.2 Potential Air Quality Effect Levels on Soils, Vegetation and Wildlife

7.2.1 Soils

The potential and hypothesized effects of atmospheric deposition on soils include:

- Increased soil acidification
- Alteration in cation exchange
- Loss of base cations
- Mobilization of trace metals

The potential sensitivity of specific soils to atmospheric inputs is related to two factors. First, the physical ability of a soil to conduct water vertically through the soil profile is important in influencing the interaction with deposition. Second, the ability of the soil to resist chemical changes, as measured in terms of pH and soil cation exchange capacity, is important in determining how a soil responds to atmospheric inputs.

7.2.2 Vegetation

The concentrations of the pollutants, duration of exposure, and frequency of exposure influence the response of vegetation to atmospheric pollutants. The pattern of pollutant exposure expected from the facility is that of a few episodes of relatively high ground-level concentration, which occur during certain meteorological conditions, interspersed with long periods of extremely low ground-level concentrations. If there are any effects of stack emissions on plants, they will be from the short-term, higher doses. A dose is the product of the concentration of the pollutant and duration of the exposure.

In general, the effects of air pollutants on vegetation occur primarily from SO₂, NO₂, O₃, and PM. Effects from minor air contaminants, such as fluoride, chlorine, hydrogen chloride, ethylene, ammonia, hydrogen sulfide, CO, and pesticides, have also been reported in the literature. The effects of air pollutants are dependent both on the concentration of the contaminant and the duration of the exposure. The term “injury,” as opposed to damage, is commonly used to describe all plant responses to air contaminants and will be used in the context of this analysis. Air contaminants are thought to interact primarily with plant foliage, which is considered to be the major pathway of exposure.

Injury to vegetation from exposure to various levels of air contaminants can be termed acute, physiological, or chronic. Acute injury occurs as a result of a short-term exposure to a high contaminant concentration and is typically manifested by visible injury symptoms ranging from chlorosis (discoloration) to necrosis (dead areas). Physiological or latent injury occurs as the result of a long-term exposure to contaminant concentrations below those that result in acute injury symptoms. Chronic injury results from repeated exposure to low concentrations over extended periods of time, often without any visible symptoms, but with some effect on the overall growth and productivity of the plant. In this assessment, 100 percent of the particular air pollutant in the ambient air was assumed to interact with the vegetation, which is a very conservative approach.

Sulfur Dioxide

Sulfur is an essential plant nutrient usually taken up as sulfate ions by the roots from the soil solution. When SO₂ in the atmosphere enters the foliage through pores in the leaves, it reacts with water in the leaf interior to form sulfite ions. Sulfite ions are highly toxic. They interact with enzymes, compete with normal metabolites, and interfere with a variety of cellular functions (Horsman and Wellburn, 1976). However, within the leaf, sulfite is

oxidized to sulfate ions, which can then be used by the plant as a nutrient. Small amounts of sulfite may be oxidized before they prove harmful.

Observed SO₂ effect levels for several plant species and plant sensitivity groupings are presented in Tables 7-1 and 7-2, respectively. SO₂ gas at elevated levels has long been known to cause injury to plants. Acute SO₂ injury usually develops within a few hours or days of exposure, and symptoms include marginal, flecked, and/or intercostal necrotic areas that appear water-soaked and dullish green initially. This injury generally occurs to younger leaves. Chronic injury is usually evident by signs of chlorosis, bronzing, premature senescence, reduced growth, and possible tissue necrosis (EPA, 1982). Background levels of SO₂ range from 2.5 to 25 µg/m³.

Many studies have been conducted to determine the effects of high-concentration, short-term SO₂ exposure on natural community vegetation. Sensitive plants include ragweed, legumes, blackberry, southern pine, and red and black oak. These species are injured by exposure to 3-hour SO₂ concentrations of 790 to 1,570 µg/m³. Intermediate plants include locust and sweetgum. These species are injured by exposure to 3-hour SO₂ concentrations of 1,570 to 2,100 µg/m³. Resistant species (injured at concentrations above 2,100 µg/m³ for 3 hours) include white oak and dogwood (EPA, 1982).

A study of native Floridian species (Woltz and Howe, 1981) demonstrated that cypress, slash pine, live and oak exposed to 1,300 µg/m³ SO₂ for 8 hours were not visibly damaged. This finding supports the levels cited by other researchers on the effects of SO₂ on vegetation. A corroborative study (McLaughlin and Lee, 1974) demonstrated that approximately 20 percent of a cross-section of plants ranging from sensitive to tolerant was visibly injured at 3-hour SO₂ concentration of 920 µg/m³. Jack pine seedlings exposed to SO₂ concentrations of 470 to 520 µg/m³ for 24 hours demonstrated inhibition of foliar lipid synthesis; however, this inhibition was reversible (Malhotra and Kahn, 1978). Black oak exposed to 1,310 µg/m³ SO₂ for 24 hours a day for 1 week demonstrated a 48-percent reduction in photosynthesis (Carlson, 1979).

SO₂ is considered to be the primary factor causing the death of lichens in most urban and industrial areas. The first indications of damage from SO₂ include the inhibition of nitrogen fixation, increased electrolyte leakage, and decreased photosynthesis and respiration followed by discoloration and death of the algal component of the lichen (Fields, 1988). Sensitive species are damaged or killed by annual average levels of SO₂ ranging from 8 to 30 µg/m³, and very few lichens can tolerate levels exceeding 125 µg/m³ (Johnson, 1979; DeWit, 1976; Hawsworth and Rose, 1970; LeBlanc et al., 1972). In another study, two lichen species exhibited signs of SO₂ damage in the form of decreased biomass gain and photosynthetic rate as well as membrane leakage when exposed to concentrations of 200 to 400 µg/m³ for 6 hours/week for 10 weeks (Hart et al., 1988).

Acidic precipitation is formed from SO₂ emissions during the burning of fossil fuels. This pollutant is oxidized to sulfur trioxide in the atmosphere and dissolves in rain to form SAM, which falls as acidic precipitation (Ravera, 1989). Although concentration data are not available, SAM has been reported to yield necrotic spotting on the upper surfaces of leaves (Middleton et al., 1950).

Nitrogen Dioxide

NO₂ can injure plant tissue with symptoms usually appearing as irregular white to brown collapsed lesions between the leaf veins and near the margins. Conversely, non-injurious levels of NO₂ can be absorbed by plants, enzymatically transformed into ammonia, and incorporated into plant constituents such as amino acids (Matsumaru, et al., 1979).

For plants that have been determined to be more sensitive to NO₂ exposure than others, acute exposure (1, 4, and 8 hours) caused 5 percent predicted foliar injury at concentrations ranging from 3,800 to 15,000 µg/m³ (Heck and Tingey, 1979). Chronic exposure of selected plants (some considered NO₂ sensitive) to NO₂ concentrations of 2,000 to 4,000 µg/m³ for 213 to 1,900 hours caused reductions in yield of up to 37 percent and some chlorosis (Zahn, 1975). Short-term exposure to NO_x at concentrations of 564 µg/m³ caused adverse effects in lichen species (Holopainen and Karenlampi, 1984).

Particulate Matter

Although information pertaining to the effects of PM on plants is scarce, baseline concentrations are available (Mandoli and Dubey, 1988). Ten species of native Indian plants were exposed to levels of PM that ranged from 210 to 366 µg/m³ for an 8-hour averaging period. Damage in the form of a higher leaf area/dry weight ratio was observed at varying degrees for most plants tested. Concentrations of PM lower than 163 µg/m³ did not appear to be injurious to the tested plants.

Carbon Monoxide

Information pertaining to the effects of CO on plants is scarce. The main effect of high concentrations of CO is the inhibition of cytochrome c oxidase, the terminal oxidase in the mitochondrial electron transfer chain. Inhibition of cytochrome c oxidase depletes the supply of adenosine triphosphate (ATP), the principal donor of free energy required for cell functions. However, this inhibition only occurs at extremely high concentrations of CO. Pollok, et al. (1989) reported that exposure to a CO:O₂ ratio of 25 (equivalent to an ambient CO concentration of 6.85×10⁶ µg/m³) resulted in stomatal closure in the leaves of the sunflower (*Helianthus annuus*). Naik, et al. (1992) reported cytochrome c oxidase inhibition in corn, sorghum, millet, and Guinea grass at CO:O₂ ratios of 2.5 (equivalent to an ambient CO concentration of 6.85×10⁵ µg/m³). These plants were considered the species most sensitive to CO-induced inhibition of cytochrome c oxidase.

Ozone

O₃ can cause various damage to broad-leaved plants including: tissue collapse, interveinal necrosis, and markings on the upper surface leaves known as stippling (pigmented yellow, light tan, red brown, dark brown, red, or purple), flecking (silver or bleached straw white), mottling, chlorosis or bronzing, and bleaching. O₃ can also stunt plant growth and bud formation. On certain plants such as citrus, grape, and tobacco, it is common for leaves to wither and drop early.

7.2.3 Wildlife

A wide range of physiological and ecological effects to fauna has been reported for gaseous and particulate pollutants (Newman, 1981; Newman and Schreiber, 1988). The most severe of these effects have been observed at concentrations above the secondary NAAQS. Physiological and behavioral effects have been observed in experimental animals at or below these standards. For impacts on wildlife, the lowest threshold values of SO₂, NO_x, and particulates that are reported to cause physiological changes are shown in Table 7-3.

7.2.4 Impact Analysis Methodology

A screening approach was used that compared the Project's maximum predicted ambient concentrations of air pollutants of concern in the vicinity of the site and the Saint Marks NWA PSD Class I Area with effect threshold limits for both vegetation and wildlife as reported in the scientific literature. A literature search was conducted to determine the effects of air contaminants on plant species as well as those species reported to occur in the vicinity of the site and in the PSD Class I area. It is recognized that effect threshold information is not available

for all species found in these areas, although studies have been performed on a few of the common species and on other species known to be sensitive indicators of effects. Species of lichens, which are symbiotic organisms comprised of green or blue-green algae and fungi, have been used worldwide as air pollution monitors because relatively low levels of sulfur-, nitrogen-, and fluorine-containing pollutants adversely affect many species, altering lichen community composition, growth rates, reproduction, physiology, and morphological appearance (Blett, et al., 2003).

7.3 Impacts on Soils, Vegetation, Wildlife, and Visibility in the Project's Vicinity

7.3.1 Impacts on Vegetation and Soils

According to the modeling results presented in Section 6.0, the maximum air quality impacts due to the proposed Project are predicted to be below the NAAQS and PSD increments. The NAAQS were established to protect both public health and welfare. Public welfare is protected by the secondary NAAQS, which Florida has adopted. Secondary standards set limits to protect public welfare, including protection against visibility impairment, damage to animals, crops, vegetation, and buildings (EPA, 2007).

Since the project's impacts on the local air quality are predicted to be less than the NAAQS and less than the effect levels on soils and vegetation, the project's impacts on soils, vegetation, and wildlife in the vicinity of the site are expected to be negligible. With regard to O₃ concentrations, the Project's VOC and NO_x emissions (precursors to O₃ formation) represent an insignificant increase in VOC and NO_x emissions.

7.3.2 Impacts on Wildlife

The major air quality risk to wildlife in the United States is from continuous exposure to pollutants above the NAAQS. This occurs in non-attainment areas. Risks to wildlife also may occur for wildlife living in the vicinity of an emission source that experiences frequent upsets or episodic conditions resulting from malfunctioning equipment, unique meteorological conditions, or startup operations (Newman and Schreiber, 1988). Under these conditions, chronic effects (e.g., particulate contamination) and acute effects (e.g., injury to health) have been observed (Newman, 1981).

Although air pollution impacts to wildlife have been reported in the literature, many of the incidents involved acute exposures to pollutants, usually caused by unusual or highly concentrated releases or unique weather conditions. It is highly unlikely that emissions from the Project will cause adverse effects to wildlife due to the new Project's low impacts, which are predicted to be below the NAAQS based on worst-case operation. Coupled with the mobility of wildlife, the potential for exposure of wildlife to the project's impacts is extremely unlikely. In addition, the Project replaces CT-1 and CT-2 located at the same location. These factors are expected to provide an improvement in the air quality in the vicinity of the Hopkins Plant area.

7.3.3 Visibility

No visibility impairment in the vicinity of Project is expected due to the types and quantities of emissions proposed for the Project. The opacity of the Wartsila engines will be 10 percent or less since only natural gas will be used. In addition, with the retirement of Unit 1 any visible plumes from the Hopkins Plant will be significantly reduced. The Project will utilize an air cooled radiator that has no vapor plume.

7.4 Impacts to the Saint Marks NWA PSD Class I Area

7.4.1 Identification of AQRVs and Methodology

The U.S. Department of the Interior in 1978 defined AQRVs to be:

- All those values possessed by an area except those that are not affected by changes in air quality and include all those assets of an area whose vitality, significance, or integrity is dependent in some way upon the air environment. These values include visibility and those scenic, cultural, biological, and recreational resources of an area that are affected by air quality.
- Important attributes of an area are those values or assets that make an area significant as a national monument, preserve, or primitive area. They are the assets that are to be preserved if the area is to achieve the purposes for which it was set aside (Federal Register, 1978).

The AQRVs include visibility, freshwater and coastal wetlands, dominant plant communities, unique and rare plant communities, soils and associated periphyton, and the wildlife dependent on these communities for habitat. Rare, endemic, threatened, and endangered species of the national park and bioindicators of air pollution (e.g., lichens) are also required to be evaluated. For the Project, the AQRVs required to be evaluated is related to visibility due primarily to emissions of PM₁₀, PM_{2.5}, and NO_x.

7.4.2 Impacts Upon Visibility

Introduction

The Clean Air Act Amendments of 1977 provide for implementation of guidelines to prevent visibility impairment in mandatory Class I areas. The guidelines are intended to protect the aesthetic quality of these pristine areas from reduction in visual range and atmospheric discoloration due to various pollutants. Sources of air pollution can cause visible plumes if emissions of PM₁₀, PM_{2.5}, and NO_x are sufficiently large. A plume will be visible if its constituents scatter or absorb sufficient light so that the plume is brighter or darker than its viewing background (e.g., the sky or a terrain feature, such as a mountain). PSD Class I areas, such as national parks and wilderness areas, are afforded special visibility protection designed to prevent plume visual impacts to observers within a Class I area.

Visibility is an AQRV for the Saint Marks NWA. Visibility can take the form of plume blight for nearby areas or regional haze for long distances (e.g., distances beyond 50 km). For areas of the Saint Marks NWR located within 50 km from the Hopkins Plant the change in visibility was analyzed as plume blight and the following methodology discussed in the following paragraphs was used to address the Project's impacts on that AQRV.

Methodology

An analysis to determine the potential adverse plume visibility effects in the Saint Marks NWA was conducted using the screening approach suggested in the Workbook for Plume Visual Impact Screening and Analysis (EPA, 1992), which has been computerized by EPA in a program called the VISCREEN model. The VISCREEN model is currently recommended by FDEP and EPA to assess visual plume impacts in regulatory applications at Class I areas located within 50 km from a project site. The Saint Marks NWA Class I area is between 38.6 and 58 km from the proposed project site. The VISCREEN model can be used to calculate potential plume impact of specific pollutant emissions for specific transport and meteorological dispersion conditions. The model can be applied in two successive levels of screening (i.e., referred to as Levels 1 and 2) without the need for extensive source, meteorological, or pollutant input. If the screening calculations demonstrate that, during worst-case

meteorological conditions a plume is imperceptible or, if perceptible, is not likely to be considered objectionable (“adverse” or “significant” in the language of the EPA PSD and visibility regulations), and further analysis of plume visual impact would not be required as part of the air quality review of the source. However, if the screening analyses demonstrate that the criteria are exceeded, plume visual impacts cannot be ruled out, and more detailed analyses to ascertain the magnitude, frequency, location, and timing of plume visual impacts would be required.

The Level 1 screening analysis is designed to provide a conservative estimate of plume visual impacts (i.e., impacts that would be larger than those calculated with more realistic input and modeling assumptions). This analysis assumes worst-case meteorological conditions of stable stability (Pasquill-Gifford stability Class F) and a 1 m/s wind speed persisting for 12 hours in one direction towards a PSD Class I area. The input required for the Level 1 analysis is limited to the following parameters:

- Emission rates of PM₁₀, PM_{2.5}, and NO_x
- Distance between the emission source and (a) the observer; (b) the closest Class I area boundary; and (c) the most distant Class I area boundary
- Background visual range appropriate for the region in which the Class I area is located
- If available, emission rates of NO₂, soot, and primary sulfate. For this analysis, the Project’s H₂SO₄ emissions were included as primary sulfate

Visibility impacts are then determined for two parameters:

- Contrast of a plume against a viewing background such as the sky or a terrain feature
- Perceptibility of a plume on the basis of the color difference between the plume and the viewing background (Delta E)

Results are provided by the model for several scenarios based on the background view, the viewing angle, visibility improvement due to plumes located both inside and outside the Class I area, and the sun angle. Only those impacts identified as being inside the Class I area are relevant for the proposed project as impacts outside the Class I area are only relevant for several integral vistas located in the northeastern US. The critical values for contrast and Delta E are 0.05 and 2.00, respectively. If these levels are not exceeded by the proposed source, the source is considered to pass the Level 1 visibility analysis, and to not have a significant impact on the Class I area.

Additionally, the Saint Marks NWA is at sea-level and the terrain between the project site and the PSD Class I area is considered as generally flat with no adverse terrain features. With no terrain features that can be used as a viewing background, visibility impacts were determined using the sky as the only viewing background.

Natural gas is the only fuel that the proposed engines will use. The input parameters and results of the Level 1 analysis for the project are presented in Figure 7-1. As shown, the project will emit PM₁₀, NO_x, and primary SO₄ (sulfate as sulfuric acid mist). The maximum short-term average emission rates used in the analysis, which are presented in Section 2.0, are based on the engines operating at baseload conditions. Primary NO₂ and soot are not emitted in significant quantities by combustion sources; therefore, these emissions were set to the default value of zero.

The background visual range for Saint Marks was assumed to be 190 km which represents the largest value for monthly average natural conditions visual range as presented in Table V.1-6 of the Federal Land Manager’s *Air*

Quality Related Values Workgroup (FLAG), Phase I Report (Revised 2010). Other parameters input to the model were based upon default values given in the Workbook and incorporated into the computer model.

Results

As shown in Figure 7-1, for the proposed project's maximum emissions, 24-hour visibility Impacts at the Saint Marks NWA are calculated to be less than the Level 1 visibility screening criteria. As a result, the Project is not expected to have an adverse impact on the existing visibility at that PSD Class I area.

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Tables

Table 2-1: Stack, Operating, and Emission Data
Wartsila Model 18V50SG Engine, Natural Gas

Operating Load and Emission Data				
Parameter	Units	100% Load	70% Load	40% Load
CT/HRSG Stack Data				
Height	ft	75	75	75
Diameter	ft	5.3	5.3	5.3
Temperature	°F	684.0	754.0	822.0
Stack Exhaust Velocity	ft/sec	94.7	71.3	46.2
Maximum Hourly Emissions				
SO ₂	lb/hr	0.875	0.644	0.401
PM/PM ₁₀ /PM _{2.5}	lb/hr	3.170	2.480	2.150
NO _x	lb/hr	2.440	1.910	1.100
CO	lb/hr	4.960	3.880	2.240
VOC (as methane)	lb/hr	4.920	3.850	3.600
Sulfuric Acid Mist	lb/hr	0.134	0.099	0.061

Sources: Wartsila, 2018; Golder, 2018.

**Table 2-2: Summary of Maximum Potential Annual Emissions
Wartsila Model 18V50SG Engine, Natural Gas**

Engine Operating Mode	Annual operating hours at each operating mode ^a						
	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	
Base Load	8,760	4,760	4,760	2,760	0	0	
70% Load	0	4,000	0	3,000	8,760	0	
40% Load	0	0	4,000	3,000	0	8,760	
Maximum Potential Annual Emissions (TPY)							Annual Emissions One Engine (TPY)
Pollutant							
SO ₂	3.83	3.37	2.88	2.77	2.82	1.76	3.8
PM/PM ₁₀ /PM _{2.5}	13.88	12.50	11.84	11.32	10.86	9.42	13.9
NO _x	10.69	9.63	8.01	7.88	8.37	4.82	10.7
CO	21.72	19.56	16.28	16.02	16.99	9.81	21.7
VOC (as methane)	21.55	19.41	18.91	17.96	16.86	15.77	21.5
Sulfuric Acid Mist	0.59	0.52	0.44	0.42	0.43	0.27	0.59

^a Hourly emissions (lb/hr) for each engine normal operation

Pollutant	Base	70% Load	40% Load
SO ₂	0.875	0.644	0.401
PM/PM ₁₀ /PM _{2.5}	3.170	2.480	2.150
NO _x	2.440	1.910	1.100
CO	4.960	3.880	2.240
VOC (as methane)	4.920	3.850	3.600
Sulfuric Acid Mist	0.134	0.099	0.061

Source: Golder Associates, 2018.

**Table 2-3: Emissions for Project Compared to PSD SERs
Wartsila Model 18V50SG Engine, Natural Gas**

Pollutant	Maximum Potential Emissions One Engine (TPY)	PSD Significant Emission Rate (TPY)
SO ₂	3.8	40
PM	13.9	25
PM ₁₀	13.9	15
PM _{2.5}	13.9	10
NO _x	10.7	40
CO	21.7	100
VOC (as methane)	21.5	40
Sulfuric Acid Mist	0.6	7
Greenhouse Gases (CO ₂ e)		
CO ₂	84,019.5	
CH ₄	38.9	
N ₂ O	46.4	
Total CO ₂ e	84,104.9	75,000

Note: SER = significant emission rate

Source: Golder, 2018.

Table 2-4: Annual Average Emissions for Arvah B. Hopkins Generating Station Unit 1 for Each Consecutive Two-Year Period, 2013-2017

Pollutant	Annual Emissions for Boiler #1					Two-Year Average Emissions			
	2017	2016	2015	2014	2013	2017-2016 (tons)	2016-2015 (tons)	2015-2014 (tons)	2014-2013 (tons)
NO _x	191.6	201.6	174.7	158.5	143.7	196.6	188.2	166.6	151.1
CO	91.18	86.85	80.7	76.6	74.9	89.0	83.8	78.6	75.7
SO ₂	0.6	0.7	0.6	0.6	0.4	0.7	0.7	0.6	0.5
VOC	5.97	5.7	5.3	5.0	4.9	5.8	5.5	5.1	5.0
PM	8.249	7.9	7.5	7.9	6.8	8.1	7.7	7.7	7.3
PM ₁₀	8.249	7.9	7.5	7.9	6.8	8.1	7.7	7.7	7.3
PM _{2.5}	8.249	7.9	1.8	1.7	1.7	8.1	4.9	1.8	1.7
SAM ^a	0.091875	0.11	0.09	0.09	0.06	0.10	0.10	0.09	0.08
CO ₂	132,430.55	135,382.0	117,729.5	111,340.4	104,503.9	133,906.3	126,555.7	114,535.0	107,922.1
N ₂ O ^b (CO ₂ e)	73.3	69.5	65.1	60.9	59.5	71.4	67.3	63.0	60.2
CH ₄ ^b (CO ₂ e)	61.5	58.3	54.6	51.1	49.9	59.9	56.5	52.8	50.5

^a Not reported in AORs - based on assuming 10% of SO₂ converts to SO₃, all of which converts to SAM.

^b Calculated based on actual annual heat input and 40 CFR Part 98 Subpart C emission factors. See Table B-3.

Source: Annual Operating Report (AOR) for Arvah B. Hopkins Generating Station, 2013 - 2017; EPA's Acid Rain database.

Table 2-5: PSD Applicability - Arvah B. Hopkins Generating Station Project, Contemporaneous Emission Increases and Decreases

Pollutant	Project Potential Emissions (TPY)	Contemporaneous Emission^a Decreases - Unit 1 (TPY)	Contemporaneous Emission Increases Four Engines (TPY)	Net Increase/Decrease in Annual Emissions^b (TPY)	PSD Significant Emission Rates (TPY)	PSD Review Required?^c
NO _x	10.7	196.60	42.7	-143.2	40	No
CO	21.7	89.02	86.9	19.6	100	No
SO ₂	3.8	0.65	15.3	18.5	40	No
VOC	21.5	5.84	86.20	101.9	40	Yes
PM	13.9	8.07	55.5	61.3	25	Yes
PM ₁₀	13.9	8.07	55.5	61.3	15	Yes
PM _{2.5}	13.9	8.07	55.5	61.3	10	Yes
SAM	0.6	0.10	2.3	2.8	7	No
GHGs						
CO ₂	80,018.6	133,906.3	320,074.5	266,186.8		
N ₂ O (CO ₂ e)	37.1	71.4	148.4	114.1		
CH ₄ (CO ₂ e)	44.2	59.9	176.9	161.2		
Total GHGs (CO ₂ e)	80,099.9	134,037.6	320,399.7	266,462.0	75,000	Yes

^a Maximum 2-Year average emissions - see Tables 2-4.

^b Net Increase/Decrease in Emissions = Potential Project emissions - baseline actual emissions for Unit 1 + potential emissions from four RICE generators.

^c Threshold applies only if PSD review triggered for regulated air pollutants other than GHG.

Table 3-1: National and State AAQS, Allowable PSD Increments and Significant Impact Levels

Pollutant	Averaging Time	National and Florida AAQS ($\mu\text{g}/\text{m}^3$)		PSD Increments ($\mu\text{g}/\text{m}^3$)		Significant Impact Levels ($\mu\text{g}/\text{m}^3$)	
		Primary Standard	Secondary Standard	Class I	Class II	Class I	Class II
Particulate Matter (PM_{10}) ^a	Annual Arithmetic Mean	NA	NA	4	17	0.2	1
	24-Hour Maximum	150	150	4	30	0.3	5
Particulate Matter ($\text{PM}_{2.5}$) ^a	Annual Arithmetic Mean	12	15	1	4	0.06	0.3
	24-Hour Maximum	35	35	2	9	0.07	1.2
Sulfur Dioxide ^b	Annual Arithmetic Mean	80	NA	2	20	0.1	1
	24-Hour Maximum	365	NA	5	91	0.2	5
	3-Hour Maximum	NA	1,300	25	512	1	25
	1-Hour Maximum	197	NA	NA	NA	NA	7.9 ^e
Carbon Monoxide	8-Hour Maximum	10,000	10,000	NA	NA	NA	500
	1-Hour Maximum	40,000	40,000	NA	NA	NA	2,000
Nitrogen Dioxide ^c	Annual Arithmetic Mean	100	100	2.5	25	0.1	1
	1-Hour Maximum	188	NA	NA	NA	NA	7.6 ^e
Ozone ^d	1-Hour Maximum	NA	NA	NA	NA	NA	NA
	8-Hour Maximum	147	147	NA	NA	NA	NA
Lead	Rolling 3-Month Average	0.15	0.15	NA	NA	NA	NA

Note: NA = not applicable.

AAQS = ambient air quality standard.

^a On October 17, 2006, EPA promulgated revised PM_{10} and $\text{PM}_{2.5}$ AAQS; the $\text{PM}_{2.5}$ AAQS had been promulgated on July 18, 1997. For PM_{10} , the annual standard was revoked and the 24-hour standard was retained. The 24-hour $\text{PM}_{2.5}$ standard was revised to $35 \mu\text{g}/\text{m}^3$ based on the 3-year averages of the 98th percentile values. The annual $\text{PM}_{2.5}$ standard of $15 \mu\text{g}/\text{m}^3$, 3-year averages at community monitors, was retained.

^b On June 23, 2010, EPA promulgated the 1-hour SO_2 standard at a level of 75 parts per billion (ppb), based on the 3-year average of the annual 99th percentile of 1-hour daily maximum concentrations (effective August 23, 2010). EPA is also revoking both the existing 24-hour and annual primary SO_2 standards, effective one year after the designation of an area, pursuant to section 107 of the Clean Air Act.

^c On February 9, 2010, EPA promulgated the 1-hour NO_2 standard at a level of 100 ppb, based on the 3-year average of the annual 99th percentile of 1-hour daily maximum concentrations (effective April 12, 2010).

^d On March 27, 2008, EPA promulgated revised AAQS for ozone. The O_3 standard was modified to be 0.075 ppm ($147 \mu\text{g}/\text{m}^3$) for the 8-hour average; achieved when the 3-year average of 99th percentile values is 0.075 ppm or less.

^e For NO_2 and SO_2 1-hour averaging period, an interim Class II significant impact level is shown.

Sources: FR, Vol. 43, No. 118, June 19, 1978; 40 CFR 50; 40 CFR 52.21; Florida Chapter 62.204, F.A.C. Golder, 2018.

Table 4-1: Summary of VOC BACT Determinations for Natural Gas-Fired Internal Combustion Engines (2008-1018) as of 10/2018

Facility Name	State	RBLC ID	Permit Issued	Process Info	MW/Heat Input		Control Method	VOC Limit	Basis
Florida									
City of Tallahassee	FL	NA	9/26/2017	(4) Natural Gas fired RICE	75.28	MW	GCP, Clean Fuels Oxidation Catalytic and Selective Catalytic Reduction	26.0 ppmvd @ 15% O2 (70% and 100% load) 42.0 ppmvd @ 15% O2 (40% load)	BACT-PSD
Other States									
Gold Coast Packing	CA	CA-1240	3/17/2017	Internal Combustion Engine	881	HP	GCP, Clean Fuels Oxidation Catalyst	25.0 ppmvd	BACT-PSD
Holland Board Of Public Works - East 5th Street	MI	MI-0424	12/5/2016	Emergency engine	1,462	HP	GCP, Clean Fuels Oxidation Catalyst	0.5 g/HP-hr	BACT-PSD
Mid-Kansas Electric Co., Rubart Station	KS	KS-0030	3/31/2016	(24) Spark ignition RICE (2) Spark ignition RICE emergency generators	10 MW 450 kW		GCP, Clean Fuels Oxidation Catalyst GCP, Clean Fuels	5.82 lb/hr 1.0 g/HP-hr	BACT-PSD BACT-PSD
Cameron Insterstate Pipeline LLC - Holbrook Compressor Station	LA	LA-0292	1/22/2016	(12) Compressor Engines	5,000	HP	GCP, Clean Fuels Oxidation Catalyst	1.25 lb/hr	BACT-PSD
Delaware Basin Midstream, Ramsey Gas Plant	TX	TX-0755	5/21/2015	(5) Natural Gas IC Compressor Engines	206,149	MMBtu/yr	GCP, Clean Fuels Oxidation Catalyst	0.091 g/HP-hr	BACT-PSD
NFG Midstream Compressor Station - Clermont Compressor Station	PA	PA-0302	4/16/2014	(7) Spark Ignited 4 stroke Rich Burn Engine	--	--	GCP, Clean Fuels Non-Selective Catalytic Reduction	0.200 g/HP-hr	BACT-PSD
Markwest Liberty Midstream, Carpenter Compressor Station	PA	PA-0301	3/31/2014	(3) Four Stroke Lean Burn Engine Four Stroke Lean Burn Engine	2,370 BHP 3,550 HP		GCP, Clean Fuels Oxidation Catalyst GCP, Clean Fuels Oxidation Catalyst	0.250 g/BHP-hr 0.250 g/BHP-hr	BACT-PSD BACT-PSD
Tradewind Energy, INC. - Lacey Randall Generation Facility, LLC.	KS	KS-0035	1/24/2014	Spark ignition four stroke lean burn RICE	12,526	BHP	GCP, Clean Fuels Oxidation Catalytic and Selective Catalytic Reduction	2.670 lb/hr	BACT-PSD
South Texas Electric Cooperative, Red Gate Power Plant	TX	TX-0692	12/20/2013	(12) internal combustion engines	18	MW	GCP, Clean Fuels Oxidation Catalyst	0.300 g/HP-hr	BACT-PSD
Holland Board of Public Works	MI	MI-0412	12/4/2013	Emergency Engine	1,000	kW	GCP, Clean Fuels Oxidation Catalyst	0.500 g/HP-hr	BACT-PSD
WTG Sonora Gas Plant LLC - Sonora Gas Plant	TX	TX-0680	6/14/2013	Refrigeration compressor engine Recompression compressor engine	1183 HP 1,380 HP		GCP, Clean Fuels Oxidation Catalyst GCP, Clean Fuels Oxidation Catalyst	0.245 g/HP-hr 0.245 g/HP-hr	BACT-PSD BACT-PSD
Kelly IMG Energy LLC	PA	PA-0297	5/23/2013	(2) Generators	3.11	MW	GCP, Clean Fuels Oxidation Catalyst	0.176 g/BHP-hr	BACT-PSD
Semgas LP - Rose Valley Plant	OK	OK-0153	3/1/2013	(10) Emergency engine	1,775.00	HP	GCP, Clean Fuels Oxidation Catalyst	0.130 g/HP-hr	BACT-PSD
Markwest Buffalo Creek Gas Co., LLC	OK	OK-0148	9/12/2012	Large Internal Combustion Engine Large Internal Combustion Engine	1,775.00 HP 2,370.00 HP		GCP, Clean Fuels Oxidation Catalyst GCP, Clean Fuels Oxidation Catalyst	0.220 g/HP-hr 0.220 g/HP-hr	BACT-PSD BACT-PSD
Markwest Liberty Midstream, Welling Compressor Station	PA	PA-0287	9/27/2011	(2) Compressor Engines (4) Compressor Engines	1,312.00 kW 1,980.00 HP		GCP, Clean Fuels Oxidation Catalyst GCP, Clean Fuels 3-way Catalyst	0.120 g/BHP-hr 0.120 g/BHP-hr	BACT-PSD BACT-PSD
Kyocera America Inc.	CA	CA-1222	9/22/2011	Spark Igition	2,889.00	BHP	GCP, Clean Fuels Oxidation Catalyst	30.000 ppmvd @ 15% O2	BACT-PSD
Consumers Energy, Ray Compressor Station	MI	MI-0393	10/14/2010	Emergency generator (5) Natural Gas fired spark ignition	-- 4,735.00 HP	--	GCP, Clean Fuels GCP, Clean Fuels Oxidation Catalyst	0.810 g/BHP-hr 0.190 g/BHP-hr	BACT-PSD BACT-PSD
Medicine Bow Fuel & Power Medicine Bow IGL Plant	WY	WY-0066	3/4/2009	Black Start Generator #1	2,889.00	HP	GCP, Clean Fuels	0.900 g/HP-hr	BACT-PSD
				Black Start Generator #2	2,890.00	HP	GCP, Clean Fuels	0.900 g/HP-hr	BACT-PSD
				Black Start Generator #3	2,889.00	HP	GCP, Clean Fuels	0.900 g/HP-hr	BACT-PSD
Gulf Crossing Pipeline Co., Sterlington Compressor Station	LA	LA-0232	6/24/2008	Compressor Engine	4,735.00	HP	GCP, Clean Fuels Oxidation Catalyst	1.840 lb/hr	BACT-PSD
				Emergency generator	838.00	HP	GCP, Clean Fuels	1.390 lb/hr	BACT-PSD

Source: EPA 2018 (RBLC database); Golder, 2018
Note: DLN= dry low NOx; GCP= good combustion practices.

Table 4-2: Summary of PM BACT Determinations for Large Natural Gas-Fired Internal Combustion Engines (2008-2018) as of 10/2018

Facility Name	State	RBLC ID	Permit Issued	Process Info	MW/Heat Input	Control Method	PM/PM ₁₀ /PM _{2.5} Limit	Equivalent PM/PM ₁₀ /PM _{2.5} Emissions Rate	Basis
Florida									
City of Tallahassee	FL	NA	9/26/2017	(4) Natural Gas fired RICE	75.28 MW	GCP, Clean Fuels, NH ₃ Slip Limit	10 ppmv of NH ₃		BACT-PSD
Other States									
DTE Gas Company - Milford Compressor Station	MI	MI-0426	3/24/2017	Natural Gas Emergency Engine	1,818 HP	GCP, Clean Fuels	0.01 lb/MMBtu	0.01 lb/MMBtu	BACT-PSD
Holland Board Of Public Works - East 5th Street	MI	MI-0424	12/5/2016	Natural Gas Emergency Engine	1,462 HP	GCP, Clean Fuels	0.01 lb/MMBtu	0.01 lb/MMBtu	BACT-PSD
DTE Gas Company - Milford Compressor Station	MI	MI-0420	6/3/2016	Natural Gas Emergency Engine	1,506 kW	GCP, Clean Fuels	0.01 lb/MMBtu	0.01 lb/MMBtu	BACT-PSD
Mid-Kansas Electric Company, LLC - Rubart Station	KS	KS-0030	3/31/2016	(24) spark ignition 4SLB RICE EGUs	10 MW	GCP, Clean Fuels	1.31 lb/MMBtu	1.31 lb/MMBtu	BACT-PSD
				(2) spark ignition emergency	450 kW	GCP, Clean Fuels	0.0001 g/HP-hr		BACT-PSD
Cameron Insterstate Pipeline LLC - Holbrook Compressor Station	LA	LA-0292	1/22/2016	(12) Compressor Engines	5,000 HP	GCP, Clean Fuels	0.003 lb/hr		BACT-PSD
Columbia Gulf Transmission Company	LA	LA-0287	07/212014	Emergency Generator Reciprocating Engine	1,175 HP	GCP, Clean Fuels	0.004 lb/hr		BACT-PSD
Mag Pellet LLC	IN	IN-0185	4/24/2014	(2) Emergency Generators	620 HP	GCP, Clean Fuels	0.2 g/kW-hr		BACT-PSD
Tradewind Energy, INC. Lacey Randall Generation Facility, LLC	KS	KS-0035	1/24/2014	(10) internal combustion engine (RICE) electric generating units	9.34 MW	GCP, Clean Fuels	2.22 lb/hr		BACT-PSD
South Texas Electric Cooperative, LLC - Red Gate Power Plant	TX	TX-0692	12/20/2013	(12) reciprocating internal combustion engines	18 MW	GCP, Clean Fuels, NH ₃ Slip Limit	10 ppmv of NH ₃		BACT-PSD
Holland Board Of Public Works - East 5th Street	MI	MI-0412	12/4/2013	Emergency Engine	1000 kW	GCP, Clean Fuels	0.01 lb/MMBtu	0.01 lb/MMBtu	BACT-PSD
Magnetation LLC	IN	IN-0167	4/16/2013	Emergency Generator	620 HP	GCP, Clean Fuels	0.2 g/kW-hr		BACT-PSD
Semgas LP - Rose Valley Plant	OK	OK-0153	3/1/2013	(2) Emergency Generators	2889 HP	GCP, Clean Fuels	0.01 lb/MMBtu	0.01 lb/MMBtu	BACT-PSD
				Compressor Engine	1775 HP	GCP, Clean Fuels	0.01 lb/MMBtu	0.01 lb/MMBtu	BACT-PSD
Markwest Buffalo Creek Gas Co LLC	OK	OK-0148	9/12/2012	Large Internal Combustion Engine	1775 HP	GCP, Clean Fuels	0.01 lb/MMBtu	0.01 lb/MMBtu	BACT-PSD
				Large Internal Combustion Engine	2370 HP	GCP, Clean Fuels	0.01 lb/MMBtu	1.01 lb/MMBtu	BACT-PSD
VC Energy LLC Mindalnd Power Station LLC	MI	MI-0401	12/21/2011	Emergency Generator	1200 kW	GCP, Clean Fuels	0.00999 lb/MMBtu	0.00999 lb/MMBtu	BACT-PSD
Westlake Vinyls Company LP - Cogeneration Plant	LA	LA-0256	12/6/2011	Emergency Generator	1818 HP	GCP, Clean Fuels	0.01 lb/MMBtu	0.01 lb/MMBtu	BACT-PSD
Sabine Pass LNG, LP & Sabine Pass Liquefaction, LLC - Sabine Pass LNG Terminal	LA	LA-0257	12/6/2011	(2) Generators Engines	2012 HP	GCP, Clean Fuels	0.75 lb/hr		BACT-PSD
Avenal Power Center LLC - Avenal Energy Project	CA	CA-1192	6/21/2011	Emergency Engine	550 kW	GCP, Clean Fuels	0.34 g/HP-hr		BACT-PSD

Source: EPA 2018 (RBLC database); Golder, 2018
Note: GCP= good combustion practices; LSF= low sulfur fuel; NG = natural gas; CC = combined cycle; CT = combustion turbine; DB = duct burner; HRSG = heat recovery steam generator.

Table 4-3: Summary of CO₂e BACT Determinations for Large Natural Gas-Fired Internal Combustion Engines (2008-2018) as of 10/2018

Facility Name	State	RBLC ID	Permit Issued	Process Info	MW/Heat Input	Control Method	CO ₂ e Limit (mass)	CO ₂ e Limit	Basis
Florida									
City of Tallahassee	FL	NA	9/26/2017	(4) Natural Gas fired RICE	75.28 MW	GCP, Clean Fuels		1,110 lb/MWH	BACT-PSD
Other States									
Dominion Energy Transmission, INC Mockingbird Hill Compressor Sta	WV	WV-0031	6/14/2018	Emergency Generator	755 HP	GCP, Clean Fuels	161 TPY		BACT-PSD
DTE Gas Company - Milford Compressor Station	MI	MI-0426	3/24/2017	Natural Gas Emergency Engine	1,818 HP	Energy Efficiency, Clean Fuel	247 TPY		BACT-PSD
Holland Board Of Public Works - East 5th Street	MI	MI-0424	12/5/2016	Natural Gas Emergency Engine	1,462 HP	GCP, Clean Fuels	116 TPY		BACT-PSD
DTE Gas Company - Milford Compressor Station	MI	MI-0420	6/3/2016	Natural Gas Emergency Engine	1,506 kW	Energy Efficiency, Clean Fuel	198 TPY	1,168 lb/MWH	BACT-PSD
Mid-Kansas Electric Company, LLC - Rubart Station	KS	KS-0030	3/31/2016	(24) spark ignition 4SLB RICE EGUs	10 MW	GCP, Clean Fuels	10,692 lb/hr	1,250 lb/MWH	BACT-PSD
Cameron Insterstate Pipeline LLC - Holbrook Compressor Station	LA	LA-0292	1/22/2016	(12) Compressor Engines	5,000 HP	GCP, Clean Fuels	21,170 TPY	0.97 lb/HP-hr	BACT-PSD
Nuevo Midstream LLC, Ramsey Gas Station	TX	TX-0746	11/18/2014	(5) Gas-Fired Internal Combustion Compression Engines	206,149 MMBtu/yr	GCP, Clean Fuels	7,849 TPY	412.3 lb CO2 /MMscf	BACT-PSD
Columbia Gulf Transmission Company	LA	LA-0287	07/212014	Emergency Generator Reciprocating Engine	1,175 HP	GCP, Clean Fuels	1,160 lb/hr	0.987 g/HP-hr	BACT-PSD
APEX Matagorda Energy Center, LLC	TX	TX-0742	4/14/2014	Emergency Generator	8,600 scf/hr	GCP, Clean Fuels	23 TPY		BACT-PSD
APEX Bethel Energy Center, LLC	TX	TX-0741	3/13/2014	Emergency Generator	8,600 scf/hr	GCP, Clean Fuels	23 TPY		BACT-PSD
Tradewind Energy, INC. Lacey Randall Generation Facility, LLC	KS	KS-0035	1/24/2014	(4) internal combustion engine (RICE) electric generating units	9.34 MW	GCP, Clean Fuels	9,330 lb/hr		BACT-PSD
South Texas Electric Cooperative, Red Gate Power Plant	TX	TX-0692	12/20/2013	(12) internal combustion engines	18 MW	Energy Efficiency, Clean Fuel		1,145 lb/MWH	BACT-PSD
Holland Board Of Public Works - East 5th Street	MI	MI-0412	12/4/2013	Emergency Engine	1,000 kW	Energy Efficiency, Clean Fuel	116 TPY		BACT-PSD
CF Industries Nitrogen, LLC, Donaldsonville Nitrogen Complex	LA	LA-0311	7/15/2013	Emergency Engine	2,500 HP	Energy Efficiency, Clean Fuel	526.51 TPY		BACT-PSD
Magnetation LLC	IN	IN-0167	4/16/2013	Emergency Generator	620 HP	Energy Efficiency, Clean Fuel	144 TPY	0.93 lb/HP-hr	BACT-PSD
Copano Processing L.P. Houston Central Gas Plant	TX	TX-0636	3/8/2013	(2) Combustion Turbines	15,000 HP	GCP, Clean Fuels	65,097 TPY		BACT-PSD
Semgas LP - Rose Valley Plant	OK	OK-0153	3/1/2013	(2) Emergency Generators	2,889 HP	Energy Efficiency, Clean Fuel		8,212 Btu/BHP-hr	BACT-PSD
				Compressor Engine	1,775 HP	Energy Efficiency, Clean Fuel		8,452 Btu/BHP-hr	BACT-PSD
				Large Internal Combustion Engine	1,775 HP	Energy Efficiency, Clean Fuel		7,900 Btu/BHP-hr	BACT-PSD
Markwest Buffalo Creek Gas Co LLC	OK	OK-0148	9/12/2012	Large Internal Combustion Engine	2,370 HP	Energy Efficiency, Clean Fuel		7,900 Btu/BHP-hr	BACT-PSD
Atlas Pipeline Midcontinent Westok, LLC, Waynoka Natural Gas Proc	OK	OK-0142	1/17/2012	(3) Large Internal Combustion Engines	10,650 HP	Energy Efficiency, Clean Fuel		7,116 Btu/BHP-hr	
Westlake Vinyls Company LP - Cogeneration Plant	LA	LA-0256	12/6/2011	Emergency Generator	1,818 HP	Energy Efficiency, Clean Fuel	1,509 lb/hr	0.83 lb/HP-hr	BACT-PSD
Sabine Pass LNG, LP & Sabine Pass Liquefaction, LLC - Sabine Pass LNG Terminal	LA	LA-0257	12/6/2011	(2) Generators Engines	2,012 HP	Energy Efficiency, Clean Fuel	412 TPY	0.82 lb/HP-hr	BACT-PSD

Source: EPA 2018 (RBLC database); Golder, 2018
Note: GCP= good combustion practices; LSF= low sulfur fuel; NG = natural gas; CC = combined cycle; CT = combustion turbine; DB = duct burner; HRSG = heat recovery steam generator.

Table 5-1: Summary of Maximum PM_{2.5} and PM₁₀ Measurements in Vicinity of COT Hopkins Plant, 2015 to 2017

Site No.	Location	Measurement Period		Concentration (µg/m³)		
				24-Hour		Annual ^b Mean
				2nd Highest	98th Percentile	
PM _{2.5} AAQS				NA	35	12
012-073-0012	110 Century Park Circle West Tallahassee, FL	2015	Jan-Dec	17.3	17.0	7.6
		2016	Jan-Dec	18.6	16.0	6.7
		2017	Jan-Dec	20.2	19.0	8.0
		3-Yr Average		18.7	17.3	7.4
PM ₁₀ AAQS				150	NA	NA
012-091-0002	720 Lovejoy Rd Fort Walton Beach, FL	2015	Jan-Dec	62.0		
		2016	Jan-Dec	35.0		
		2017	Jan-Dec	60.0		
		3-Yr Average		52.3		

Note: NA = not applicable.
AAQS = ambient air quality standard.

^a The 24-hour PM_{2.5} standard is met when the 3-year average of the 98th percentile of the daily values is less than 35 µg/m³.

^b The annual PM_{2.5} standard is met when the 3-year average of the annual mean values is less than 12 µg/m³.

Source: FDEP Quicklook Reports, 2015-2017.

Table 6-1: Structure Dimensions Used in the Modeling Analysis

BPIP Building ID	Description	Height		Length		Width	
		(ft)	(m)	(ft)	(m)	(ft)	(m)
<u>Existing Structures</u>							
UNIT1BLD	Unit 1 Main Level	73.0	22.3	284.0	86.6	114.0	34.7
UNIT1BLD	Unit 1 Upper Level	125.3	38.2	66.4	20.2	58.7	17.9
UNIT1STH	Unit 1 Southern Tier	32.0	9.8	95.0	29.0	48.2	14.7
UNIT1LO	Unit 2 Lower Level	24.0	7.3	65.2	19.9	27.4	8.4
UNIT2HI	Unit 2 Upper Level	177.5	54.1	111.9	34.1	75.6	23.0
UNIT2MID	Unit 2 Mid Level	107.3	32.7	87.8	26.8	57.2	17.4
UNIT2LO	Unit 2 Lower Level	73.0	22.3	69.0	21.0	12.8	3.9
HRSGBLDG	HRSG Building	93.8	28.6	120.4	36.7	34.7	10.6
CTINLET1	CT Air Intake	65.1	19.8	27.4	8.4	15.5	4.7
CHILLER	Chiller	29.5	9.0	75.0	22.9	56.0	17.1
LM60001LO	LM6000(1) - Lower	22.5	6.9	44.0	13.4	33.0	10.1
LM60001HI	LM6000(1) - Upper	59.0	18.0	45.8	14.0	13.5	4.1
LM60002LO	LM6000(2) - Lower	22.5	6.9	44.0	13.4	33.0	10.1
LM60002HI	LM6000(2) - Upper	59.0	18.0	45.8	14.0	13.5	4.1
SWITCHYD	Switch Yard Bldg	20.0	6.1	58.6	17.9	24.5	7.5
DEMINWH	Demin WH	26.0	7.9	202.8	61.8	61.8	18.8
WH	Warehouse	26.0	7.9	99.3	30.3	77.4	23.6
COOLTOW2	Cooling Tower 2	32.0	9.8	38.5	11.7	72.5	22.1
COOLTOW1	Cooling Tower 1	32.0	9.8	191.0	58.2	40.6	12.4
<u>Proposed Structures</u>							
ENGBLDG	Wartsila Engine Bldg	44.5	13.6	175.7	53.6	101.0	30.8
ELECTBLDG	Wartsila Electric Hall	21.5	6.6	77.8	23.7	47.7	14.5

Table 6-2: Summary of the PM Facilities Considered for Inclusion in the Air Modeling Analyses

Facility ID	Facility Description	Site	UTM Coordinates		Relative to COT Hopkins Facility ^a				Potential PM Emissions (TPY)	Q, (TPY) Emission Threshold ^b			Include in Modeling Analysis ? ^b
			Zone 16		X (km)	Y (km)	Distance (km)	Direction (deg)		PM10 (24 h)	PM2.5 (24 h)	PM2.5 (Annual)	
			East (km)	North (km)									
<u>Modeling Area ^a</u>													
0730003	CITY OF TALLAHASSEE	ARVAH B. HOPKINS GENERATING STATION	747.2	3371.5	-2.6	-0.1	0.00	0	243.0	SIA	SIA	SIA	YES
<u>Beyond Modeling Area ^a</u>													
7770100	C.W. ROBERTS CONTRACTING, INC.	TALLAHASSEE ASPHALT PLANT	752.7	3370.8	2.9	-0.8	3.01	105	10.7	52.6	29.0	53.6	NO
7770255	SMYRNA READY MIX CONCRETE, LLC	SRM PLANT #104	750.4	3368.3	0.6	-3.3	3.37	170	1.4	59.8	36.2	60.8	NO
0730068	FAIRCHILD CREMATION SERVICES INC	CAPITAL CITY CREMATORY	754.2	3373.6	4.4	2.0	4.82	65	2.2	88.8	65.2	89.8	NO
7775067	SMYRNA READY MIX CONCRETE, LLC	SRM PLANT #102	746.7	3375.6	-3.1	4.0	5.02	322	0.6	92.9	69.3	93.9	NO
0730052	TERMINAL SERVICE COMPANY, INC.	CEMENT PLANT	755.0	3373.4	5.2	1.8	5.47	71	0.01	101.8	78.2	102.8	NO
7775144	PEAVY & SON CONSTRUCTION CO INC	MIDWAY ASPHALT PLANT	744.6	3375.0	-5.2	3.4	6.21	303	8.8	116.5	92.9	117.5	NO
0730010	FLORIDA STATE UNIVERSITY	FLORIDA STATE UNIVERSITY	759.5	3370.9	9.7	-0.7	9.74	94	6.9	187.2	163.6	188.2	NO
0730113	CITY OF TALLAHASSEE	T P SMITH WRF	757.1	3365.1	7.3	-6.5	9.75	132	3.8	187.5	163.9	188.5	NO
0730076	NORTH FLORIDA ANIMAL HOSPITAL	NORTH FLORIDA ANIMAL HOSPITAL	759.1	3375.0	9.3	3.4	9.86	70	2.1	189.6	166.0	190.6	NO
0730009	FLORIDA A&M UNIVERSITY	PHYSICAL PLANT/CENTRAL HEATING PLANT	760.5	3368.9	10.7	-2.7	11.04	104	16.1	213.1	189.5	214.1	NO
0730116	CITY OF TALLAHASSEE	TALLAHASSEE SUBSTATION 12	763.1	3372.9	13.3	1.3	13.36	84	14.0	259.5	235.9	260.5	NO
0730042	SERVICE CORPORATION INTERNATIONAL (SCI)	CULLEY'S MEADOWWOOD CREMATORY	765.0	3373.2	15.2	1.6	15.29	84	0.4	298.1	274.5	299.1	NO
0730034	MITCHELL BROTHERS, INC.	MITCHELL BROTHERS PLANT #3	766.2	3372.1	16.4	0.5	16.41	88	14.8	320.6	297.0	321.6	NO
0730119	JIMMIE CROWDER EXCAVATING & LAND CLEARIN	JIMMIE CROWDER EX & LAND CLEAR, INC	766.0	3363.0	16.2	-8.6	18.34	118	22.8	359.2	335.6	360.2	NO
0390041	ACTIVE MINERALS INTERNATIONAL, LLC	ACTIVE MINERALS INT LLC - ATTAPULGITE DI	731.0	3384.0	-18.8	12.4	22.52	303	9.6	442.8	419.2	443.8	NO
0390033	NORTH FLORIDA CREMATORY	BEVIS FUNERAL HOME	732.6	3386.4	-17.2	14.8	22.73	311	4.6	447.0	423.4	448.0	NO
0390009	COASTAL FOREST RESOURCES COMPANY	COASTAL PLYWOOD COMPANY, HAVANA, FLORIDA	745.2	3394.1	-4.6	22.5	22.99	348	145.4	452.2	428.6	453.2	NO
0390005	BASF CORPORATION	QUINCY OPERATIONS	732.6	3387.5	-17.2	15.9	23.42	313	307.5	460.9	437.3	461.9	NO
0390030	IMERYS PERLITE USA, INC	IMERYS PERLITE USA INC	729.8	3385.2	-20.0	13.6	24.19	304	49.7	476.1	452.5	477.1	NO
0390025	ARGOS USA	QUINCY READY MIX PLANT	726.9	3382.4	-22.9	10.8	25.27	295	14.2	497.8	474.2	498.8	NO
0730114	JOHNSTONE AG & RECYCLING	THE BARN	775.6	3374.1	25.8	2.5	25.96	84	16.3	511.6	488.0	512.6	NO
0390029	FLORIDA GAS TRANSMISSION COMPANY	GADSDEN COUNTY COMPRESSOR STATION NO 14	720.0	3377.4	-29.8	5.8	30.39	281	36.3	600.1	576.5	601.1	NO
0770009	TELOGIA POWER LLC	TELOGIA POWER LLC	707.7	3357.8	-42.1	-13.8	44.33	252	96.7	879.0	855.4	880.0	NO
0390045	CDS MANUFACTURING INC	CDS-FDOT CASTING YARD	723.8	3387.7	-26.0	16.1	30.56	302	5.0	603.6	580.0	604.6	NO
0390039	FORTERRA PIPE & PRECAST, LLC	FORTERRA PIPE & PRECAST - GRETNA	724.2	3389.1	-25.6	17.5	31.01	304	1.7	612.7	589.1	613.7	NO
1290003	ST. MARKS POWDER, INC.	ST. MARKS POWDER	767.6	3342.4	17.8	-29.2	34.16	149	32.2	675.6	652.0	676.6	NO
1290001	TALLAHASSEE CITY PURDOM GENERATING STA.	TALLAHASSEE CITY PURDOM GENERATING STA.	766.8	3339.9	17.0	-31.7	36.01	152	85.0	712.5	688.9	713.5	NO
0770010	GEORGIA PACIFIC WOOD PRODUCTS LLC	G-P WOOD PRODUCTS LLC (HOSFORD OSB)	713.8	3369.5	-36.0	-2.1	36.06	267	595.2	713.6	690.0	714.6	NO
0650004	ARGOS USA	LLOYD READY MIX PLANT	785.8	3375.5	36.0	3.9	36.24	84	0.8	717.3	693.7	718.3	NO
7774811	CW ROBERTS CONTRACTING	HOSFORD ASPHALT PLANT	711.0	3365.2	-38.8	-6.4	39.37	261	1.9	779.8	756.2	780.8	NO
0770012	TELOGIA LUMBER LLC	TELOGIA MILL	710.4	3357.8	-39.4	-13.8	41.79	251	15.4	828.2	804.6	829.2	NO
0650006	JEFFERSON COUNTY BOARD OF COUNTY COMMS	JEFFERSON COUNTY CENTRAL LANDFILL ACI	219.6	3369.3	-530.2	-2.3	46.11	267	1.5	914.6	891.0	915.6	NO
<u>Georgia</u>													
08700037	BASF CATALYSTS LLC		739.9	3403.2	-9.9	31.6	33.06	343	203.4	653.5	629.9	654.5	NO
08700053	BAINBRIDGE POWER FACILITY		734.4	3422.3	-15.4	50.7	53.01	343	9.8	1052.7	1029.1	1053.7	NO

Note: SID = Significant impact distance for the project

COT Hopkins Wartsila Engines Locations East and North Coordinates (km) are approximately:
The significant impact distance for the project is estimated to be:

749.80 km 3371.6 km
PM10 (24 H) 0.38 km
PM2.5 (24 H) 1.56 km
PM2.5 (Annual) 0.33 km

^a "Modeling Area" is the area in which the project is predicted to have a significant impact (1.25 km). All sources within the modeling area were included in the analysis.

^b In general, sources beyond the modeling areas were included if the emission rate in TPY > Q where Q = (Distance - SID)*20. Also, sources with PTE> 100 TPY and located within 10 km were included.

Table 6-3: Summary of Background PM Sources Included in the NAAQS Modeling Analysis

Facility ID	Facility Name Emission Unit Description	EU ID	Modeling ID Name	UTM Location		Height		Diameter		Temperature		Velocity		Stack Parameter Data Source	PM _{2.5} Emission Rate		Emissions Data Source
				X (m)	Y (m)	ft	m	ft	m	°F	K	ft/s	m/s		(lb/hr)	(g/s)	
0730003	COT A.B. Hopkins Generating Station																
	GE LM6000 Sprint Combustion Turbine HC3 with Inlet Chilling	031	HC3	749,849	3,371,676	85.0	25.91	10.0	3.05	825.0	713.7	127.6	38.9	October 2018 from FDEP Query Report	14.9	1.88	October 2018 from FDEP
	GE LM6000 Sprint Combustion Turbine HC4 with Inlet Chilling	032	HC4	749,910	3,371,677	85.0	25.91	10.0	3.05	825.0	713.7	127.6	38.9		14.9	1.88	October 2018 from FDEP
	GE 7FA CT Combined Cycle Mode	033	HP2ACC	749,657	3,371,873	150.0	45.72	18.0	5.49	188.0	359.8	66.6	20.3		25.6	3.22	October 2018 from FDEP

Notes:
All emission rates are based on worst case emission/impact scenario.

Table 6-4: Maximum Concentrations Predicted For Five 18 MW Wartsila Engines on Natural Gas Compared to EPA Class II SIL

Pollutant	Averaging Time	Maximum Predicted Concentration ^b (µg/m ³)	Receptor Location		Time Period (YYMMDDHH)	EPA Class II Significant Impact Levels (µg/m ³)
			UTM- East (m)	UTM- North (m)		
PM ₁₀	Annual	0.44	750,137	3,371,325	14123124	1
	24-Hour	5.2	749,972	3,372,054	17040524	5
PM _{2.5} - Primary	Annual	0.37	750,137	3,371,325	5 Year Avg.	0.2
	24-Hour	2.75	750,138	3,371,284	5 Year Avg.	1.2
PM _{2.5} - Secondary ^a	Annual	0.002	-	-	-	0.2
	24-Hour	0.063	-	-	-	1.2
PM _{2.5} - Total	Annual	0.37	750,137	3,371,325	5 Year Avg.	0.2
	24-Hour	2.81	750,138	3,371,284	5 Year Avg.	1.2

^a Secondary PM_{2.5} Impacts:

Project NO _x Emissions =	53.4	TPY
Project SO ₂ Emissions =	18.2	TPY
	<u>24-Hour</u>	<u>Annual</u>
NO _x MERP (TPY) =	2295	10144
SO ₂ MERP (TPY) =	628	4013

Secondary Impact = (NO_x Emissions/NO_x MERP + SO₂ Emissions/SO₂ MERP) x Sig Impact Level

^b Concentrations are based on concentrations predicted using 5 years of meteorological data from 2013 to 2017 of surface and upper air data from the National Weather Service station at Tallahassee International Airport (TLH/TAE).

Note: YYMMDDHH = Year, Month, Day, Hour Ending

Table 6-5: Maximum Predicted PM₁₀ and PM_{2.5} Impacts for All Sources As Compared to the NAAQS

Pollutant	Averaging Time and Rank	Maximum Concentration (µg/m ³) ^a			Receptor Location		Time Period (YYMMDDHH)	AAQS (µg/m ³)
		Total	Modeled Sources	Background ^b	UTM- East (m)	UTM- North (m)		
PM ₁₀	24-Hour, H6H	63.8	3.8	60.0	750,135	3,371,366	13030624	150
PM _{2.5}	Annual, Highest	7.9	0.5	7.4	750,136	3,371,325	5-year average	12
	24-Hour, 98th Percentile	19.3	2.3	17.0	750,138	3,371,284	5-year average	35

Notes: YYMMDDHH = Year, Month, Day, Hour Ending
H6H = Highest, 6th-highest over 5 years.

^a Concentrations are based on concentrations predicted using 5 years of meteorological data from 2013 to 2017 of surface and upper air data from the National Weather Service station at Tallahassee International Airport (TLH/TAE).

^b Background concentrations are based on the years 2015-2017 and were provided by FDEP

Table 6-6: Maximum Predicted PM₁₀ and PM_{2.5} Impacts Compared to the Allowable PSD Class II Increments

Pollutants	Averaging Time and Rank	Maximum Predicted Concentration ^a (µg/m ³)	Receptor Location		Time Period (YYMMDDHH)	PSD Class II Increment (µg/m ³)
			UTM- East (m)	UTM- North (m)		
PM ₁₀	24-Hour, HSH	5.17	750,135	3,371,366	16012324	30
PM _{2.5}	Annual, Highest	0.44	750,137	3,371,325	14123124	4
	24-Hour, HSH	4.70	749,942	3,372,077	17040524	9

Note: YYMMDDHH = Year, Month, Day, Hour Ending

HSH = Highest, second-highest over 5-years

^a Concentrations are based on concentrations predicted using 5 years of meteorological data from 2013 to 2017 of surface and upper air data from the National Weather Service station at Tallahassee International Airport (TLH/TAE).

Table 6-7: Maximum Concentrations Predicted for Five 18MW Wartsila Engines Compared to EPA Class I SIL

Pollutant	Averaging Time	Maximum Predicted Concentration ^b (µg/m ³)	Receptor Location		Time Period (YYMMDDHH)	EPA Class I Significant Impact Levels (µg/m ³)
			UTM- East (m)	UTM- North (m)		
<u>at all Bradwell Bay NWA Receptors</u>						
PM ₁₀	Annual	0.0054	736,996	3,346,563	13123124	0.2
	24-Hour	0.10	740,327	3,341,090	17111324	0.3
PM _{2.5} - Primary	Annual	0.005	736,996	3,346,563	5-yr aver.	0.05
	24-Hour	0.077	736,996	3,346,563	5-yr aver.	0.27
<u>at all Saint Marks NWA Receptors</u>						
PM ₁₀	Annual	0.006	769,315	3,338,066	14123124	0.2
	24-Hour	0.074	769,315	3,338,066	14111424	0.3
PM _{2.5} - Primary	Annual	0.004	769,315	3,338,066	5-yr aver.	0.05
	24-Hour	0.055	770,232	3,333,466	5-yr aver.	0.27
<u>at 50-Km Ring Distance Receptors ^c</u>						
PM ₁₀	Annual	0.008	-	-	13123124	0.2
	24-Hour	0.014	-	-	15082124	0.3
PM _{2.5} - Primary	Annual	0.006	-	-	5-yr aver.	0.05
	24-Hour	0.078	-	-	5-yr aver.	0.27
PM _{2.5} - Secondary ^a	Annual	0.0005				0.05
	24-Hour	0.014				0.27
PM _{2.5} - Total ^d	Annual	0.006				0.05
	24-Hour	0.092				0.27

^a Secondary PM_{2.5} Impacts:

Project NO _x Emissions =	53.4	TPY
Project SO ₂ Emissions =	18.2	TPY
	<u>24-Hour</u>	<u>Annual</u>
NO _x MERP (TPY) =	2295	10144
SO ₂ MERP (TPY) =	628	4013

Note: YYMMDDHH = Year, Month, Day, Hour Ending

^b Concentrations are based on concentrations predicted using 5 years of meteorological data from 2013 to 2017 of surface and upper air data from the National Weather Service station at Tallahassee International Airport (TLH/TAE).^c Concentrations predicted with AERMOD using a ring of receptors spaced at 1-degree intervals and at 50 km from Hopkins. This analysis covers the Okefenokee NWA and the section of the Saint Marks NWA that is beyond 50 km from Hopkins.^d Based on 50-Km ring distance receptors which had the highest impacts.

Table 7-1: SO₂ Effects Levels for Various Plant Species

Plant Species	Observed Effect Level (µg/m³)	Exposure (Time)	Reference
Sensitive to tolerant	920 (20 percent displayed visible injury)	3 hours	McLaughlin and Lee, 1974
Lichens	200-400	6 hr/wk for 10 weeks	Hart <i>et al.</i> , 1988
Cypress, slash pine, live oak, mangrove	1,300	8 hours	Woltz and Howe, 1981
Jack pine seedlings	470-520	24 hours	Malhotra and Kahn, 1978
Black oak	1,310	Continuously for 1 week	Carlson, 1979

Table 7-2: Sensitivity Groupings of Vegetation Based on Visible Injury at Different SO₂ Exposures ^a

Sensitivity Grouping	SO ₂ Concentration		Plants
	1-Hour	3-Hour	
Sensitive	1,310 - 2,620 µg/m ³ (0.5 - 1.0 ppm)	790 - 1,570 µg/m ³ (0.3 - 0.6 ppm)	Ragweeds Legumes Blackberry Southern pines Red and black oaks White ash Sumacs
Intermediate	2,620 - 5,240 µg/m ³ (1.0 - 2.0 ppm)	1,570 - 2,100 µg/m ³ (0.6 - 0.8 ppm)	Maples Locust Sweetgum Cherry Elms Tuliptree Many crop and garden species
Resistant	>5,240 µg/m ³ (>2.0 ppm)	>2,100 µg/m ³ (>0.8 ppm)	White oaks Potato Upland cotton Corn Dogwood Peach

^a Based on observations over a 20-year period of visible injury occurring on over 120 species growing in the vicinities of coal-fired power plants in the southeastern United States.

Source: EPA, 1982a.

Table 7-3: Examples of Reported Effects of Air Pollutants at Concentrations below National Secondary AAQS

Pollutant	Reported Effect	Concentration ($\mu\text{g}/\text{m}^3$)	Exposure
Sulfur Dioxide ^a	Respiratory stress in guinea pigs	427 to 854	1 hour
	Respiratory stress in rats	267	7 hours/day; 5 day/week for 10 weeks
	Decreased abundance in deer mice	13 to 157	continually for 5 months
Nitrogen Dioxide ^{b,c}	Respiratory stress in mice	1,917	3 hours
	Respiratory stress in guinea pigs	96 to 958	8 hours/day for 122 days
Particulates ^a	Respiratory stress, reduced respiratory disease defenses	120 PbO_3	continually for 2 months
	Decreased respiratory disease defenses in rats, same with hamsters	100 NiCl_2	2 hours

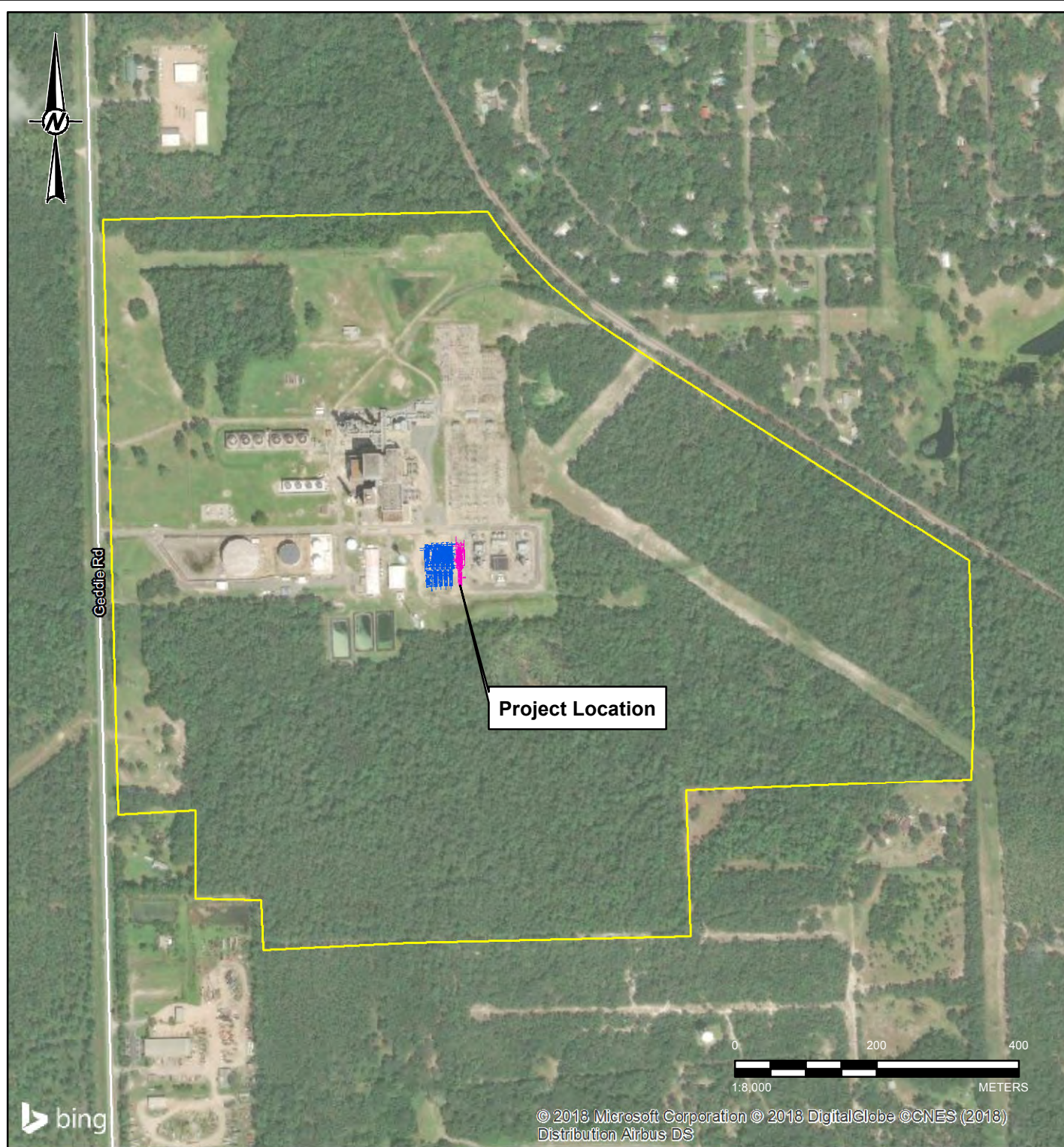
Sources: ^a Newman and Schreiber, 1988.

^b Gardner and Graham, 1976.

^c Trzeciak et al., 1977.

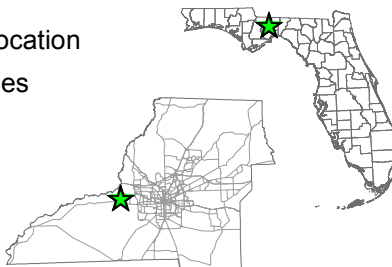
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LEGEND

- ★ Proposed Project Location
- Four Wartsila Engines under construction
- Proposed Project
- Property Boundary



REFERENCE(S)

1. PROPERTY BOUNDARY, FLORIDA DEPARTMENT OF REVENUE, 2017.

COORDINATE SYSTEM: NAD 1983 UTM ZONE 16N
PROJECTION: TRANSVERSE MERCATOR
DATUM: NORTH AMERICAN 1983

CLIENT
CITY OF TALLAHASSEE

PROJECT
HOPKINS GENERATING STATION

TITLE
**LOCATION OF PROPOSED PROJECT
AT THE A.B. HOPKINS STATION**

CONSULTANT

YYYY-MM-DD 2018-10-30



GOLDER

DESIGNED	GFD
PREPARED	GFD
REVIEWED	MS
APPROVED	SM

PROJECT NO.
18109057

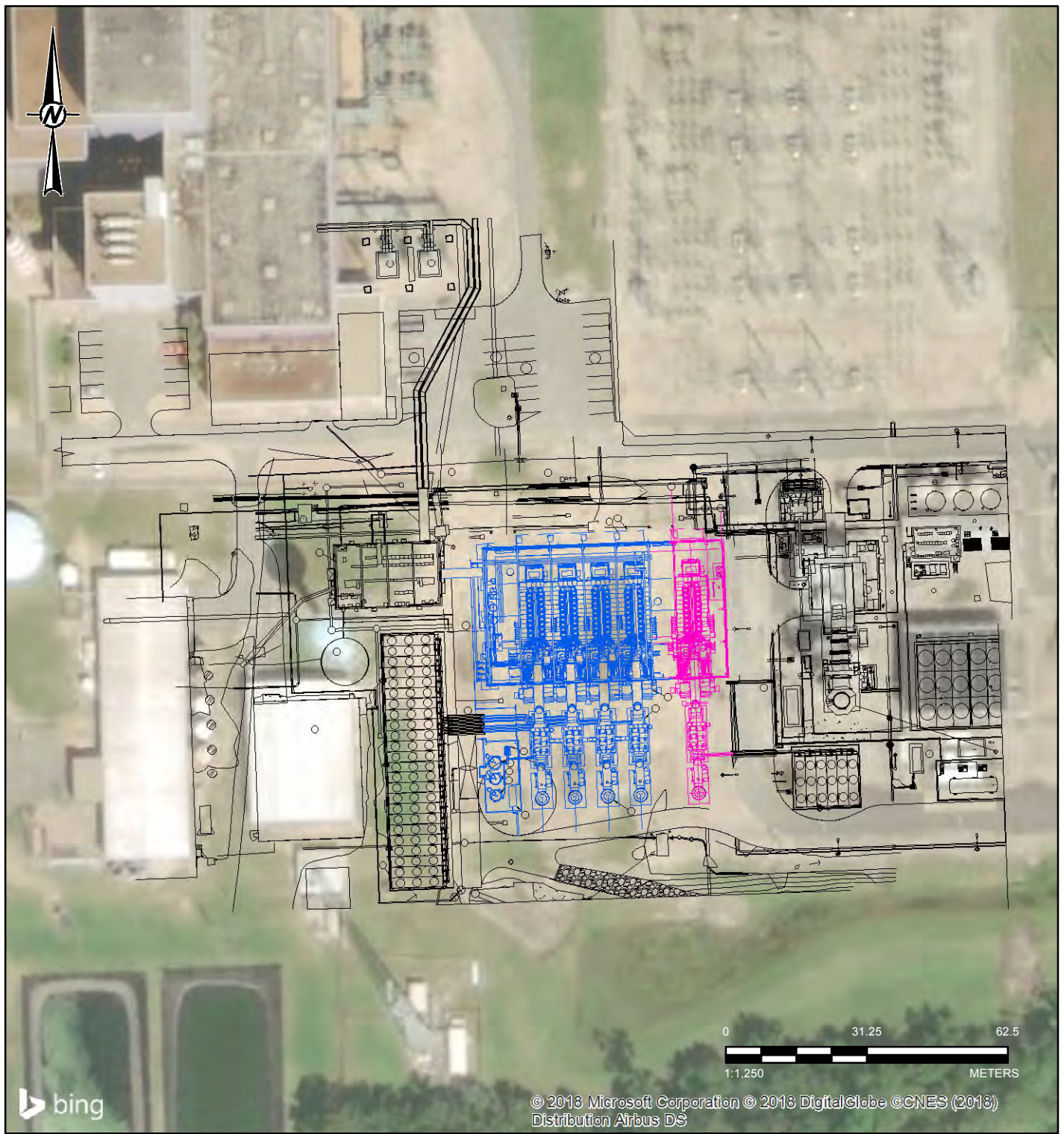
CONTROL
A001

REV.
0

FIGURE
1-1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

25mm



LEGEND

- Four Wartsila Engines under construction
- Proposed Project
- Facility Plot Plan

REFERENCE(S)

COORDINATE SYSTEM: NAD 1983 UTM ZONE 16N
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: NORTH AMERICAN 1983

CLIENT
 CITY OF TALLAHASSEE

PROJECT
 HOPKINS GENERATING STATION

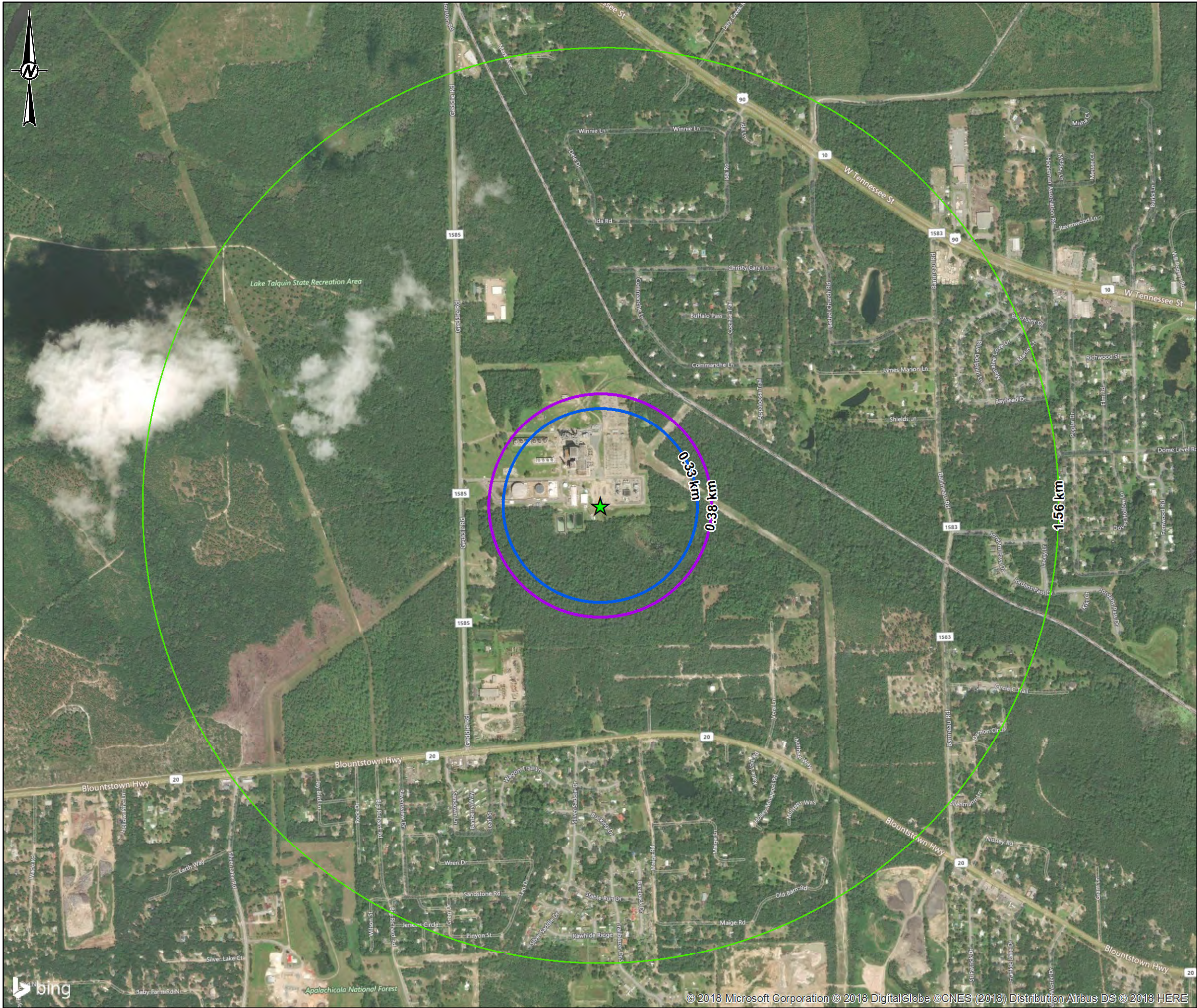
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 FACILITY PLOT PLAN

CONSULTANT	YYYY-MM-DD	2018-10-30
	DESIGNED	GFD
	PREPARED	GFD
	REVIEWED	MS
	APPROVED	SM



PROJECT NO. 18109057 CONTROL A005 REV. 0

FIGURE
 1-2



LEGEND

★ Hopkins Generating Station

Pollutant Buffers

- 24-hour PM10 SIA
- 24-hour PM2.5 SIA
- Annual PM2.5 SIA

0 330 660
METERS

REFERENCE(S)
COORDINATE SYSTEM: NAD 1983 UTM ZONE 16N
PROJECTION: TRANSVERSE MERCATOR
DATUM: NORTH AMERICAN 1983
UNITS: METER

CLIENT
CITY OF TALLAHASSEE

PROJECT
HOPKINS GENERATING STATION

TITLE
SIGNIFICANT IMPACT AREAS (SIA)

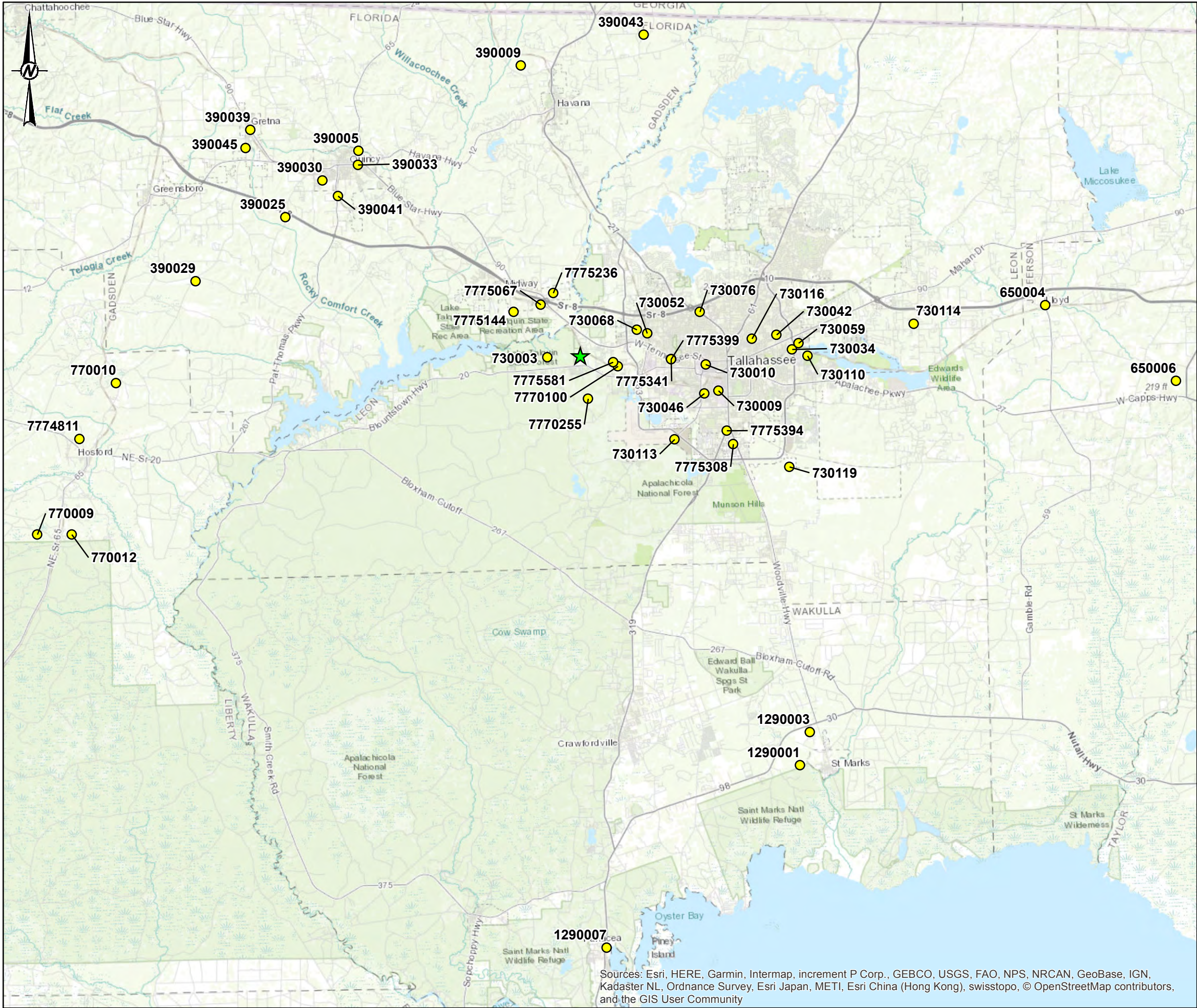
CONSULTANT	YYYY-MM-DD	2018-10-30
	DESIGNED	GFD
	PREPARED	GFD
	REVIEWED	MS
	APPROVED	SM

PROJECT NO.
18109057

CONTROL
A003

REV.
0

FIGURE
6-2



LEGEND

- Hopkins Generating Station
- PM Inventory Sources (Facility IDs)

REFERENCE(S)

COORDINATE SYSTEM: NAD 1983 UTM ZONE 16N
PROJECTION: TRANSVERSE MERCATOR
DATUM: NORTH AMERICAN 1983
UNITS: METER

CLIENT

CITY OF TALLAHASSEE

PROJECT

HOPKINS GENERATING STATION

TITLE

LOCATION OF PM BACKGROUND SOURCES

CONSULTANT	YYYY-MM-DD	2018-10-30
DESIGNED	GFD	
PREPARED	GFD	
REVIEWED	MS	
APPROVED	SM	

PROJECT NO.
18109057

CONTROL
A002

REV.
0

FIGURE
6-3

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community

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IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

Figure 7-1
Visual Effects Screening Analysis for
Source: 5 COT Wartsila 18Mw Engines
Class I Area: St. Marks NWA

*** Level-1 Screening ***

Input Emissions for

Particulates	15.85	LB /HR
NOx (as NO2)	12.20	LB /HR
Primary NO2	0.00	LB /HR
Soot	0.00	LB /HR
Primary SO4	0.64	LB /HR

**** Default Particle Characteristics Assumed

Transport Scenario Specifications:

Background Ozone:	0.04 ppm
Background Visual Range:	190.00 km
Source-Observer Distance:	38.60 km
Min. Source-Class I Distance:	38.60 km
Max. Source-Class I Distance:	58.00 km
Plume-Source-Observer Angle:	11.25 degrees
Stability:	6
Wind Speed:	1.00 m/s

R E S U L T S

Asterisks (*) indicate plume impacts that exceed screening criteria

Maximum Visual Impacts INSIDE Class I Area
Screening Criteria ARE Exceeded

Backgrnd	Theta	Azi	Distance	Alpha	Delta E		Contrast	
					Crit	Plume	Crit	Plume
SKY	10.	148.	58.0	20.	2.00	1.680	0.05	0.032
SKY	140.	148.	58.0	20.	2.00	0.393	0.05	-0.014
TERRAIN	10.	84.	38.6	84.	2.00	3.567*	0.05	0.026
TERRAIN	140.	84.	38.6	84.	2.00	0.217	0.05	0.003

Maximum Visual Impacts OUTSIDE Class I Area
Screening Criteria ARE Exceeded

Backgrnd	Theta	Azi	Distance	Alpha	Delta E		Contrast	
					Crit	Plume	Crit	Plume
SKY	10.	0.	1.0	168.	2.00	14.905*	0.05	0.278*
SKY	140.	0.	1.0	168.	2.00	3.546*	0.05	-0.116*
TERRAIN	10.	0.	1.0	168.	2.00	20.022*	0.05	0.211*
TERRAIN	140.	0.	1.0	168.	2.00	4.389*	0.05	0.102*

APPENDIX A

**Performance and Emissions
Information and Calculations**

Table A-1: Design Information and Stack Parameters for Each Engine
Wartsila Model 18V50SG, Natural Gas

Parameter	Engine Different Loads		
	100%	70%	40%
Operating Case	Case 3	Case 4	Case 5
<u>Combustion Turbine Performance</u>			
Gross Output (kW)	18,817.0	13,174.0	7,484.0
Net Heat Rate (Btu/kWh, LHV)	7,359.0	7,736.0	8,480.0
Net Heat Rate (Btu/kWh, HHV)	8,168.5	8,587.0	9,412.8
Heat Input* (MMBtu/hr, LHV)	145.4	107.0	66.6
(MMBtu/hr, HHV)	161.4	118.8	74.0
Fuel heating value (Btu/lb, LHV)	19,956	19,956	19,956
(Btu/lb, HHV)	22,151	22,151	22,151
(HHV/LHV)	1.11	1.11	1.11
<u>Fuel Usage</u>			
Heat content (Btu/cf, LHV)	950	950	950
Fuel density (lb/ft ³)	0.0476	0.0476	0.0476
Fuel usage (lb/hr)	7,286	5,362	3,339
Fuel usage (cf/hr)	153,051	112,642	70,145
<u>Stack Parameters</u>			
Stack Height (feet)	75	75	75
Diameter (feet)	5.25	5.25	5.25
<u>Stack Flow Conditions</u>			
Velocity (ft/sec) = Volume flow (acfm) / [((diameter) ² / 4) x 3.14159] / 60 sec/min			
Exhaust Temperature (°F)	684	754	822
Volume flow (acfm)	122,962	92,555	60,034
Velocity (ft/sec)- calculated	94.7	71.3	46.2

* Margin of 5 percent added to account for degradation.

Source: Wartsila 2018; Golder, 2018.

Table A-2: Maximum Emissions for Criteria Pollutants for Each Engine
Wartsila Model 18V50SG, Natural Gas

Parameter	Engine Different Loads		
	100%	70%	40%
Operating Case	Case 3	Case 4	Case 5
<u>Particulate Matter</u>			
Stack emission rate (lb/hr)	3.17	2.48	2.15
Emission Rate (lb/mmBtu, HHV)	0.0196	0.0209	0.0291
<u>Sulfur Dioxide</u>			
$SO_2 \text{ (lb/hr)} = \text{Natural gas (scf/hr)} \times \text{sulfur content (gr/100 scf)} \times 1 \text{ lb/7000 gr} \times (\text{lb } SO_2 / \text{lb S}) / 100$			
Fuel use (cf/hr)	153,051	112,642	70,145
Sulfur content (grains/ 100 cf)	2	2	2
lb SO_2 /lb S (64/32)	2	2	2
HRSG stack emission rate (lb/hr)	0.87	0.64	0.40
<u>Nitrogen Oxides</u>			
Stack emission rate (lb/hr)	2.44	1.91	1.10
Emission Rate (lb/mmBtu, HHV)	0.015	0.016	0.015
<u>Carbon Monoxide</u>			
Stack emission rate (lb/hr)	4.96	3.88	2.24
Emission Rate (lb/mmBtu, HHV)	0.031	0.033	0.030
<u>Volatile Organic Compounds</u>			
Stack emission rate (lb/hr)	4.92	3.85	3.60
Emission Rate (lb/mmBtu, HHV)	0.030	0.032	0.049
<u>Sulfuric Acid Mist</u>			
$\text{Sulfuric Acid Mist (lb/hr)} = SO_2 \text{ emission (lb/hr)} \times \text{Conversion to } H_2SO_4 \text{ (\% by weight)} / 100$			
SO_2 emission rate (lb/hr)	0.87	0.64	0.40
Conversion to H_2SO_4 (% by weight)	10	10	10
HRSG Stack emission rate (lb/hr)	0.134	0.099	0.061

Source: Wartsila, 2018; Golder, 2018.

Table A-3: Hazardous Air Pollutant Emission Factors and Emissions for the City of Tallahassee RICE Project
Wartsila Model 18V50SG, Firing Natural Gas

Parameter	Controlled Emission Factors 4SLB Gas Engine		Emission Rate (lb/hr) (One Engine)	Maximum Annual Emissions (TPY)	
			(One Engine)	(One Engine)	Five Engines
	(lb/MMBtu)		- Base Load	- Base Load	- Base Load
<u>HAPs [Section 112(b) of Clean Air Act]</u>					
1,1,2,2-Tetrachloroethane	4.00E-06	a	6.46E-04	2.83E-03	1.41E-02
1,1,2-Trichloroethan	3.18E-06	a	5.13E-04	2.25E-03	1.12E-02
1,3-Butadiene	2.67E-05	a	4.31E-03	1.89E-02	9.44E-02
1,3-Dichloropropene	2.64E-06	a	4.26E-04	1.87E-03	9.33E-03
2-Methylnaphthalene	3.32E-06	a	5.36E-04	2.35E-03	1.17E-02
2,2,4-Trimethylpentane	2.50E-05	a	4.03E-03	1.77E-02	8.84E-02
Acenaphthene	1.25E-07	a	2.02E-05	8.84E-05	4.42E-04
Acetaldehyde	3.22E-03	b	5.20E-01	2.28E+00	1.14E+01
Acrolein	4.10E-03	b	6.61E-01	2.90E+00	1.45E+01
Benzene	4.40E-05	a	7.10E-03	3.11E-02	1.56E-01
Benzo(e)pyrene	4.15E-08	a	6.70E-06	2.93E-05	1.47E-04
Benzo(b)fluoranthene	1.66E-08	a	2.68E-06	1.17E-05	5.87E-05
Benzo(g,h,i)perylene	4.14E-08	a	6.68E-06	2.93E-05	1.46E-04
Biphenyl	2.12E-05	a	3.42E-03	1.50E-02	7.49E-02
Carbon Tetrachloride	3.67E-06	a	5.92E-04	2.59E-03	1.30E-02
Chlorobenzene	3.04E-06	a	4.91E-04	2.15E-03	1.07E-02
Chloroform	2.85E-06	a	4.60E-04	2.01E-03	1.01E-02
Chrysene	6.93E-08	a	1.12E-05	4.90E-05	2.45E-04
Ethylbenzene	3.97E-06	a	6.41E-04	2.81E-03	1.40E-02
Ethylene Dibromide	4.43E-06	a	7.15E-04	3.13E-03	1.57E-02
Fluoranthene	1.11E-07	a	1.79E-05	7.85E-05	3.92E-04
Fluorene	5.67E-07	a	9.15E-05	4.01E-04	2.00E-03
Formaldehyde	1.55E-03	b	2.50E-01	1.10E+00	5.48E+00
Methanol	1.64E-03	b	2.65E-01	1.16E+00	5.79E+00
Methylene Chloride	2.00E-06	a	3.23E-04	1.41E-03	7.07E-03
n-Hexane	1.11E-04	a	1.79E-02	7.85E-02	3.92E-01
Naphthalene	7.44E-08	a	1.20E-05	5.26E-05	2.63E-04
Phenanathrene	1.04E-06	a	1.68E-04	7.35E-04	3.68E-03
Phenol	2.40E-06	a	3.87E-04	1.70E-03	8.48E-03
Pyrene	1.36E-07	a	2.19E-05	9.61E-05	4.81E-04
Styrene	2.36E-06	a	3.81E-04	1.67E-03	8.34E-03
Tetrachloroethan	2.48E-07	a	4.00E-05	1.75E-04	8.77E-04
Toluene	4.08E-05	a	6.58E-03	2.88E-02	1.44E-01
Vinyl Chloride	1.49E-06	a	2.40E-04	1.05E-03	5.27E-03
Xylene	1.84E-05	a	2.97E-03	1.30E-02	6.50E-02
HAPs (Total)			1.74	7.62	38.11

^a Based on AP-42, Table 3.2-2 Uncontrolled Emission Factors for 4-stroke Lean Burn Engines with 90% control using an oxidation catalyst.
Maximum Heat Input Rate (HHV, MMBtu/hr): 161.4

^b Wartsila, 2018.

Table A-4: Greenhouse Gas (GHG) Emissions Base Load
Wartsila Model 18V50SG, Firing Natural Gas ^a

Pollutant	One Engine		
	Emission Rate (lb/hr) at Base Load ^b	Maximum Annual GHG Emissions (TPY) ^c	Maximum Annual CO ₂ e Emissions (TPY) ^{c,d}
CO ₂	19,183	84,020	84,020
CH ₄	0.356	1.558	38.95
N ₂ O	0.036	0.156	46.43
Total		84,021	84,105

^a Heat Input Rate (HHV, MMBtu/hr): 161.4

^b CO₂ based on 40 CFR Part 75 Appendix G, Section 2.3.

CH₄ and N₂O based on Table C-2, Subpart C, 40 CFR 98. Emission factors in lb/MMBtu

Pollutant	Natural Gas
CO ₂	118.9
CH ₄	2.20E-03
N ₂ O	2.20E-04

^c CH₄ and N₂O are multiplied by CO₂e factor based on 40 CFR Part 98.

Pollutant	CO ₂ e Factor
CH ₄	25
N ₂ O	298

APPENDIX B

Baseline Actual Information for Unit 1

Table B-1: Arvah B. Hopkins Generating Station Unit 1 Annual Heat Inputs and Operating Hours, 2013 - 2017

Year	Heat Input from Residual Oil (MMBtu/yr)	Heat Input from Natural Gas (MMBtu/yr)	Total Actual Heat Input (MMBtu/yr)
2017	0	2,231,834	2,231,834
2016	0	2,117,485	2,117,485
2015	0	1,981,026	1,981,026
2014	0	1,854,639	1,854,639
2013	0	1,812,736	1,812,736

Note: All values are based on annual operating reports for the period 2013 - 2017.

Table B-2: Annual Emissions Reported in 2013-2017 Annual Operating Reports and Acid Rain Database for Unit 1

Year	Pollutant	Unit 1 (tons)
2017	NO _x	191.6
	CO	91.2
	SO ₂	0.6
	VOC	6.0
	PM	8.2
	PM ₁₀	8.2
	PM _{2.5}	8.2
	SAM ^a	0.09
	CO ₂	132,430.6
2016	NO _x	201.6
	CO	86.9
	SO ₂	0.7
	VOC	5.7
	PM	7.9
	PM ₁₀	7.9
	PM _{2.5}	7.9
	SAM ^a	0.11
	CO ₂	135,382.0
2015	NO _x	174.70
	CO	80.70
	SO ₂	0.60
	VOC	5.28
	PM	7.53
	PM ₁₀	7.53
	PM _{2.5}	1.83
	SAM ^a	0.09
	CO ₂	117,729.5
2014	NO _x	158.5
	CO	76.6
	SO ₂	0.6
	VOC	5.02
	PM	7.87
	PM ₁₀	7.87
	PM _{2.5}	1.73
	SAM ^a	0.09
	CO ₂	111,340.4
2013	NO _x	143.7
	CO	74.9
	SO ₂	0.4
	VOC	4.90
	PM	6.8
	PM ₁₀	6.8
	PM _{2.5}	1.7
	SAM ^a	0.06
	CO ₂	104,503.9

^a Not reported in AORs - based on assuming 10% of SO₂ converts to SO₃, all of which converts to SAM.

Source: Annual Operating Report (AOR) for Hopkins Plant, 2013 - 2017; EPA's Acid Rain database.

Table B-3: Actual Annual Emissions of N₂O and CH₄ for the Unit 1 - Period 2013 - 2017

Unit	Actual Annual Heat Input ^a (MMBtu/yr)	N ₂ O Emissions				CH ₄ Emissions			
		Emission Factor ^b (lb/MMBtu)	Annual Emissions		CO ₂ e ^c Rate (TPY)	Emission Factor ^b (lb/MMBtu)	Annual Emissions		CO ₂ e ^c Rate (TPY)
			(lb/yr)	(TPY)			(lb/yr)	(TPY)	
<u>Natural Gas-Firing</u>									
2017	2,231,834	2.20E-04	491.9	0.246	73.3	2.2E-03	4,919.0	2.5	61.5
2016	2,117,485	2.20E-04	466.7	0.233	69.5	2.2E-03	4,666.9	2.3	58.3
2015	1,981,026	2.20E-04	436.6	0.218	65.1	2.2E-03	4,366.2	2.2	54.6
2014	1,854,639	2.20E-04	408.8	0.204	60.9	2.2E-03	4,087.6	2.0	51.1
2013	1,812,736	2.20E-04	399.5	0.200	59.5	2.2E-03	3,995.3	2.0	49.9
<u>Residual Oil-Firing</u>									
2017	0	1.3E-03	0.0	0.00	0.0	6.6E-03	0.0	0.0	0.0
2016	0	1.3E-03	0.0	0.00	0.0	6.6E-03	0.0	0.0	0.0
2015	0	1.3E-03	0.0	0.00	0.0	6.6E-03	0.0	0.0	0.0
2014	0	1.3E-03	0.0	0.00	0.0	6.6E-03	0.0	0.0	0.0
2013	0	1.3E-03	0.0	0.00	0.0	6.6E-03	0.0	0.0	0.0
<u>Total</u>									
2017	--	--	--	0.246	73.3	--	--	2.5	61.5
2016	--	--	--	0.233	69.5	--	--	2.3	58.3
2015	--	--	--	0.218	65.1	--	--	2.2	54.6
2014	--	--	--	0.204	60.9	--	--	2.0	51.1
2013	--	--	--	0.200	59.5	--	--	2.0	49.9

^a Based on AOR data - see Table 1.

^b Table C-2, Subpart C, 40 CFR 98. Emission factors in kg/MMBtu were converted to lb/MMBtu by multiplying by 2.204.

^c N₂O and CH₄ are multiplied by a factor of 298 and 25, respectively, to determine CO₂ equivalence.

APPENDIX C

**FDEP Form No. 62-210.900(1):
Application for Air Permit - Long Form**



Department of Environmental Protection

Division of Air Resource Management

APPLICATION FOR AIR PERMIT - LONG FORM DEP FORM No. 62-210.900(1) and INSTRUCTIONS

I. APPLICATION INFORMATION

Air Construction Permit – Use this form to apply for an air construction permit:

- For any required purpose at a facility operating under a federally enforceable state air operation permit (FESOP) or Title V air operation permit;
- For a proposed project subject to prevention of significant deterioration (PSD) review, nonattainment new source review, or maximum achievable control technology (MACT);
- To assume a restriction on the potential emissions of one or more pollutants to escape a requirement such as PSD review, nonattainment new source review, MACT, or Title V; or
- To establish, revise, or renew a plantwide applicability limit (PAL).

Air Operation Permit – Use this form to apply for:

- An initial federally enforceable state air operation permit (FESOP); or
- An initial, revised, or renewal Title V air operation permit.

Identification of Facility

1. Facility Owner/Company Name: City of Tallahassee	
2. Site Name: Arvah B. Hopkins Generating Station	
3. Facility Identification Number: 0730003 ☐ Unknown	
4. Facility Location Street Address or Other Locator: 1125 Geddie Road (County Road 1585) City: Tallahassee County: Leon Zip Code: 32304	
5. Relocatable Facility? ☐ Yes ☒ No	6. Existing Title V Permitted Facility? ☒ Yes ☐ No

Application Contact

1. Application Contact Name: Russell Wider Title: Environmental Engineer	
2. Application Contact Mailing Address Organization/Firm: City of Tallahassee Street Address: 2602 Jackson Bluff Road City: Tallahassee State: FL Zip Code: 32304	
3. Application Contact Telephone Numbers Telephone: (850) 891-8710 ext. Fax: (850) 891-8277	
4. Application Contact E-mail Address: russell.wider@talgov.com	

Application Processing Information (DEP Use Only)

1. Date of Receipt of Application:	3. PSD Number (if applicable):
2. Project Number(s):	4. Siting Number (if applicable):

I. APPLICATION INFORMATION

Purpose of Application

This application for air permit is being submitted to obtain: (Check one)

Air Construction Permit

- ☒ Air construction permit.
- ☐ Air construction permit to establish, revise, or renew a plantwide applicability limit (PAL).
- ☐ Air construction permit to establish, revise, or renew a plantwide applicability limit (PAL), and separate air construction permit to authorize construction or modification of one or more emissions units covered by the PAL.

Air Operation Permit

- ☐ Initial Title V air operation permit.
- ☐ Title V air operation permit revision.
- ☐ Title V air operation permit renewal.
- ☐ Initial federally enforceable state air operation permit (FESOP) where professional engineer (PE) certification is required.
- ☐ Initial federally enforceable state air operation permit (FESOP) where professional engineer (PE) certification is not required.

Air Construction Permit and Revised/Renewal Title V Air Operation Permit (Concurrent Processing)

- ☐ Air construction permit and Title V permit revision, incorporating the proposed project.
- ☐ Air construction permit and Title V permit renewal, incorporating the proposed project.

Note: By checking one of the above two boxes, you, the applicant, are requesting concurrent processing pursuant to Rule 62-213.405, F.A.C. In such case, you must also check the following box:

- ☐ I hereby request that the department waive the processing time requirements of the air construction permit to accommodate the processing time frames of the Title V air operation permit.

Application Comment

This Air Construction/Prevention of Significant Deterioration (PSD) Permit application is for the construction of one Wartsila Model 18V50SG natural gas fired engine and electric generator that will produce 18.82 MW of electricity at 100 percent load. The Wartsila Model 18V50SG engine is the world's largest four-stroke spark-ignited gas fired reciprocating internal combustion engine equipped with a SCR to control emissions of NOx and an oxidation catalyst to control emissions of CO and VOCs. See PSD Report.

I. APPLICATION INFORMATION

Scope of Application

Emissions Unit ID Number	Description of Emissions Unit	Air Permit Type	Air Permit Processing Fee
	18.82 MW Spark Ignited Internal Combustion Engine	AC1A	\$7,500

Application Processing Fee

Check one: ☒ Attached - Amount: \$ \$7,500 ☐ Not Applicable

I. APPLICATION INFORMATION

Owner/Authorized Representative Statement

Complete if applying for an air construction permit or an initial FESOP.

1. Owner/Authorized Representative Name: Henry Gainer Title: Assistant General Manager - Energy Supply	
2. Owner/Authorized Representative Mailing Address Organization/Firm: City of Tallahassee Street Address: 2602 Jackson Bluff Road City: Tallahassee State: FL Zip Code: 32304	
3. Owner/Authorized Representative Telephone Numbers Telephone: (850) 891 - 5034 ext. Fax: () -	
4. Owner/Authorized Representative E-mail Address: Henry.Gainer@talgov.com	
5. Owner/Authorized Representative Statement: <i>I, the undersigned, am the owner or authorized representative* of the facility addressed in this air permit application. I hereby certify, based on information and belief formed after reasonable inquiry, that the statements made in this application are true, accurate and complete, and that, to the best of my knowledge, any estimates of emissions reported in this application are based upon reasonable techniques for calculating emissions. The air pollutant emissions units and air pollution control equipment described in this application will be operated and maintained so as to comply with all applicable standards for control of air pollutant emissions found in the statutes of the State of Florida and rules of the Department of Environmental Protection (Department) and revisions thereof. I understand that a permit, if granted by the Department, cannot be transferred without authorization from the Department, and I will promptly notify the Department upon sale or legal transfer of any permitted emissions unit.</i> Signature _____ Date _____	

* Attach letter of authorization if not currently on file.

I. APPLICATION INFORMATION

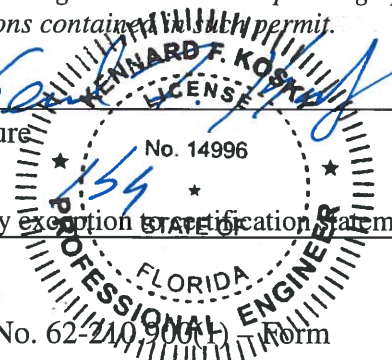
Application Responsible Official Certification

Complete if applying for an initial, revised, or renewal Title V air operation permit or concurrent processing of an air construction permit and revised or renewal Title V air operation permit. If there are multiple responsible officials, the “application responsible official” need not be the “primary responsible official.”

1. Application Responsible Official Name: _____ Title: _____			
2. Application Responsible Official Qualification (Check one or more of the following options, as applicable): ☒ For a corporation, the president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision-making functions for the corporation, or a duly authorized representative of such person if the representative is responsible for the overall operation of one or more manufacturing, production, or operating facilities applying for or subject to a permit under Chapter 62-213, F.A.C. ☐ For a partnership or sole proprietorship, a general partner or the proprietor, respectively. ☐ For a municipality, county, state, federal, or other public agency, either a principal executive officer or ranking elected official. ☐ The designated representative at an Acid Rain source or CAIR source.			
3. Application Responsible Official Mailing Address Organization/Firm: _____ Street Address: _____ City: _____ State: _____ Zip Code: _____			
4. Application Responsible Official Telephone Numbers Telephone: () - ext. Fax: () -			
5. Application Responsible Official E-mail Address:			
6. Application Responsible Official Certification: I, the undersigned, am a responsible official of the Title V source addressed in this air permit application. I hereby certify, based on information and belief formed after reasonable inquiry, that the statements made in this application are true, accurate and complete and that, to the best of my knowledge, any estimates of emissions reported in this application are based upon reasonable techniques for calculating emissions. The air pollutant emissions units and air pollution control equipment described in this application will be operated and maintained so as to comply with all applicable standards for control of air pollutant emissions found in the statutes of the State of Florida and rules of the Department of Environmental Protection and revisions thereof and all other applicable requirements identified in this application to which the Title V source is subject. I understand that a permit, if granted by the department, cannot be transferred without authorization from the department, and I will promptly notify the department upon sale or legal transfer of the facility or any permitted emissions unit. Finally, I certify that the facility and each emissions unit are in compliance with all applicable requirements to which they are subject, except as identified in compliance plan(s) submitted with this application. Signature _____ Date _____			

I. APPLICATION INFORMATION

Professional Engineer Certification

1. Professional Engineer Name: Kennard F. Kosky Florida License Number: 14996
2. Professional Engineer Mailing Address Organization/Firm: Golder Associates Inc. Street Address: 6026 NW 1st Place City: Gainesville State: FL Zip Code: 32607
3. Professional Engineer Telephone Numbers Telephone: (352) 336 - 5600 ext. Fax: (352) 336 - 6603
4. Professional Engineer E-mail Address: kkosky@golder.com
5. Professional Engineer Statement: <i>I, the undersigned, hereby certify, except as particularly noted herein*, that:</i> <i>To the best of my knowledge, there is reasonable assurance that the air pollutant emissions unit(s) and the air pollution control equipment described in this application for air permit, when properly operated and maintained, will comply with all applicable standards for control of air pollutant emissions found in the Florida Statutes and rules of the Department of Environmental Protection; and</i> <i>To the best of my knowledge, any emission estimates reported or relied on in this application are true, accurate, and complete and are either based upon reasonable techniques available for calculating emissions or, for emission estimates of hazardous air pollutants not regulated for an emissions unit addressed in this application, based solely upon the materials, information and calculations submitted with this application.</i> <i>If the purpose of this application is to obtain a Title V air operation permit (check here ☐, if so), I further certify that each emissions unit described in this application for air permit, when properly operated and maintained, will comply with the applicable requirements identified in this application to which the unit is subject, except those emissions units for which a compliance plan and schedule is submitted with this application.</i> <i>If the purpose of this application is to obtain an air construction permit (check here ☒, if so) or concurrently process and obtain an air construction permit and a Title V air operation permit revision or renewal for one or more proposed new or modified emissions units (check here ☐, if so), I further certify that the engineering features of each such emissions unit described in this application have been designed or examined by me or individuals under my direct supervision and found to be in conformity with sound engineering principles applicable to the control of emissions of the air pollutants characterized in this application.</i> <i>If the purpose of this application is to obtain an initial air operation permit or operation permit revision or renewal for one or more newly constructed or modified emissions units (check here ☐, if so), I further certify that, with the exception of any changes detailed as part of this application, each such emissions unit has been constructed or modified in substantial accordance with the information given in the corresponding application for air construction permit and with all provisions contained in such permit.</i> Signature:  Date: 12/27/18 (seal)  * Attach any exception to certification statement.

II. FACILITY INFORMATION

A. GENERAL FACILITY INFORMATION

Facility Location and Type

1. Facility UTM Coordinates Zone: 16 East (km): 749.66 North (km): 3371.8		2. Facility Latitude/Longitude Latitude (DD/MM/SS): 30/27/8 N Longitude (DD/MM/SS): 84/24/10 W	
3. Governmental Facility Code: 4	4. Facility Status Code:	5. Facility Primary Major Group SIC Code: 49	6. Facility SIC(s): 4911
7. Facility Primary NAICS 2-digit Code:		8. Facility NAICS(s) 6-digit Code(s): 221112	
9. Facility Comment: Facility Considered as an existing major source under FDEP PSD rules.			

Facility Contact

1. Facility Contact Name: Russell A. Wider Title: Environmental Engineer
2. Facility Contact Mailing Address Organization/Firm: City of Tallahassee, Environmental Resources Division Street Address: 300 South Adams Street, A-10 City: Tallahassee State: FL Zip Code: 32301
3. Facility Contact Telephone Numbers: Telephone: (850) 891 - 8710 ext. Fax: (850) 891 - 8277
4. Facility Contact E-mail Address: russell.wider@talgov.com

Facility Primary Responsible Official

Complete if an "application responsible official" is identified in Section I that is not the facility "primary responsible official."

1. Facility Primary Responsible Official Name: Henry Gainer Title: Assistant General Manager - Energy Supply
2. Facility Primary Responsible Official Mailing Address Organization/Firm: City of Tallahassee Street Address: 2602 Jackson Bluff Road City: Tallahassee State: FL Zip Code: 32304
3. Facility Primary Responsible Official Telephone Numbers Telephone: (850) 891 - 5034 ext. Fax: () -
4. Facility Primary Responsible Official E-mail Address: henry.gainer@talgov.com

II. FACILITY INFORMATION

Facility Regulatory Classifications

Check all that would apply *following* completion of all projects and implementation of all other changes proposed in this application for air permit. Refer to instructions to distinguish between a “major source” and a “synthetic minor source.”

1. ☐ Small Business Stationary Source ☐ Unknown
2. ☐ Synthetic Non-Title V Source
3. ☒ Title V Source
4. ☐ Major Source of Air Pollutants, Other than Hazardous Air Pollutants (HAPs)
5. ☐ Synthetic Minor Source of Air Pollutants, Other than HAPs
6. ☒ Major Source of Hazardous Air Pollutants (HAPs)
7. ☐ Synthetic Minor Source of HAPs
8. ☒ One or More Emissions Units Subject to NSPS (40 CFR Part 60)
9. ☒ One or More Emissions Units Subject to Emission Guidelines (40 CFR Part 60)
10. ☒ One or More Emissions Units Subject to NESHAP (40 CFR Part 61 or Part 63)
11. ☐ Title V Source Solely by EPA Designation (40 CFR 70.3(a)(5))
12. Facility Regulatory Classifications Comment: NSPS 40 CFR Part 60 Subpart A - EUs 031, 032, 033 NSPS 40 CFR Part 60 Subpart GG - EUs 031, 032 NSPS 40 CFR Part 60 Subpart KKKK - EU 033 NSPS 40 CFR Part 60 Subpart JJJJ - EUs 036-039 NESHAP 40 CFR Part 63 Subpart YYYY - EU 033 NESHAP 40 CFR Part 63 Subpart ZZZZ - EUs 006, 007, 036 - 039 Acid Rain 40 CFR Part 75 - EUs 031, 032, 033

Potential Greenhouse Gas Emissions (For PSD applications only.)

1. List the potential emissions, in tons per year, of the following greenhouse gases:

Greenhouse Gas	Tons/year	2. x GWP =	CO2e (Tons/year)
carbon dioxide		1	
nitrous oxide		298	
methane		25	
sulfur hexafluoride		22,800	
hydrofluorocarbons			
perfluorocarbons			
3. Total carbon dioxide equivalents			

4. Greenhouse Gases Comments:

See detailed GHG emissions PSD Report, Appendix A, Table A-4.

II. FACILITY INFORMATION

List of Pollutants Emitted by Facility

1. Pollutant Emitted	2. Pollutant Classification	3. Emissions Cap [Y or N]?
PM/PM10/PM2.5	A	N
CO	A	N
VOC	A	N
SO2	A	N
NOx	A	N
SAM	A	N
H095-Formaldehyde	A	N
CO2E	A	N

II. FACILITY INFORMATION

B. EMISSIONS CAPS

Facility-Wide or Multi-Unit Emissions Caps

[illegible]

II. FACILITY INFORMATION

C. FACILITY ADDITIONAL INFORMATION

Additional Requirements for All Applications, Except as Otherwise Stated

1. Facility Plot Plan: (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought) ☒ Attached, Document ID: <u>PSD Report</u> ☐ Previously Submitted, Date: _____
2. Process Flow Diagram(s): (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought) ☒ Attached, Document ID: <u>COT-EU1-I1</u> ☐ Previously Submitted, Date: _____
3. Precautions to Prevent Emissions of Unconfined Particulate Matter: (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought) ☒ Attached, Document ID: <u>PSD Report</u> ☐ Previously Submitted, Date: _____

Additional Requirements for Air Construction Permit Applications

1. Area Map Showing Facility Location ☒ Attached, Document ID: <u>PSD Report</u> ☐ Not Applicable (existing permitted facility)
2. Description of Proposed Construction, Modification, or Plantwide Applicability Limit (PAL) ☒ Attached, Document ID: <u>PSD Report</u>
3. Rule Applicability Analysis ☒ Attached, Document ID: <u>PSD Report</u>
4. List of Exempt Emissions Units ☐ Attached, Document ID: _____ ☒ Not Applicable (no exempt units at facility)
5. Fugitive Emissions Identification ☐ Attached, Document ID: _____ ☒ Not Applicable
6. Air Quality Analysis (Rule 62-212.400(7), F.A.C.) ☒ Attached, Document ID: <u>PSD Report</u> ☐ Not Applicable
7. Source Impact Analysis (Rule 62-212.400(5), F.A.C.) ☒ Attached, Document ID: <u>PSD Report</u> ☐ Not Applicable
8. Air Quality Impact since 1977 (Rule 62-212.400(4)(e), F.A.C.) ☐ Attached, Document ID: _____ ☒ Not Applicable
9. Additional Impact Analyses (Rules 62-212.400(8) and 62-212.500(4)(e), F.A.C.) ☒ Attached, Document ID: <u>PSD Report</u> ☐ Not Applicable
10. Alternative Analysis Requirement (Rule 62-212.500(4)(g), F.A.C.) ☐ Attached, Document ID: _____ ☒ Not Applicable

II. FACILITY INFORMATION

C. FACILITY ADDITIONAL INFORMATION (CONTINUED)

Additional Requirement for FESOP Applications

List of Exempt Emissions Units

☐ Attached, Document ID: _____ ☐ Not Applicable (no exempt units at facility)

Additional Requirements for Title V Air Operation Permit Applications

- | |
|--|
| 1. List of Insignificant Activities (Required for initial/renewal applications only)
☐ Attached, Document ID: _____ ☐ Not Applicable (revision application) |
| 2. Identification of Applicable Requirements (Required for initial/renewal applications, and for revision applications if this information would be changed as a result of the revision being sought. For federal regulations where applicability is dependent on the specific type of facility, provide the level of detail required to determine which specific set of regulations apply.)
☐ Attached, Document ID: _____
☐ Not Applicable (revision application with no change in applicable requirements) |
| 3. Compliance Report and Plan (Required for all initial/revision/renewal applications)
☐ Attached, Document ID: _____
Note: A compliance plan must be submitted for each emissions unit that is not in compliance with all applicable requirements at the time of application and/or at any time during application processing. The department must be notified of any changes in compliance status during application processing. |
| 4. List of Equipment/Activities Regulated under Title VI (If applicable, required for initial/renewal applications only)
☐ Attached, Document ID: _____
☐ Equipment/Activities Onsite but Not Required to be Individually Listed
☐ Not Applicable |
| 5. Verification of Risk Management Plan Submission to EPA (If applicable, required for initial/renewal applications only)
☐ Attached, Document ID: _____ ☐ Not Applicable |
| 6. Requested Changes to Current Title V Air Operation Permit
☐ Attached, Document ID: _____ ☐ Not Applicable |

II. FACILITY INFORMATION

C. FACILITY ADDITIONAL INFORMATION (CONTINUED)

Additional Requirements for Facilities Subject to Acid Rain or CAIR Program

1. **Acid Rain Program Forms:**

Acid Rain Part Application (DEP Form No. 62-210.900(1)(a))

☐ Attached, Document ID: _____ ☐ Previously Submitted, Date: _____

☒ Not Applicable (not an Acid Rain source)

Phase II NO_x Averaging Plan (DEP Form No. 62-210.900(1)(a)1.)

☐ Attached, Document ID: _____ ☐ Previously Submitted, Date: _____

☐ Not Applicable

New Unit Exemption (DEP Form No. 62-210.900(1)(a)2.)

☐ Attached, Document ID: _____ ☐ Previously Submitted, Date: _____

☐ Not Applicable

2. **CAIR Part** (DEP Form No. 62-210.900(1)(b)):

☐ Attached, Document ID: _____ ☐ Previously Submitted, Date: _____

☒ Not Applicable (not a CAIR source)

Additional Requirements Comment

EMISSIONS UNIT INFORMATION

Section [1]

18.82 MW SI Internal Combustion Engine

III. EMISSIONS UNIT INFORMATION

Title V Air Operation Permit Application - For Title V air operation permitting only, emissions units are classified as regulated, unregulated, or insignificant. If this is an application for an initial, revised or renewal Title V air operation permit, a separate Emissions Unit Information Section (including subsections A through I as required) must be completed for each regulated and unregulated emissions unit addressed in this application. Some of the subsections comprising the Emissions Unit Information Section of the form are optional for unregulated emissions units. Each such subsection is appropriately marked. Insignificant emissions units are required to be listed at Section II, Subsection C.

Air Construction Permit or FESOP Application - For air construction permitting or federally enforceable state air operation permitting, emissions units are classified as either subject to air permitting or exempt from air permitting. The concept of an “unregulated emissions unit” does not apply. If this is an application for an air construction permit or FESOP, a separate Emissions Unit Information Section (including subsections A through I as required) must be completed for each emissions unit subject to air permitting addressed in this application for air permit. Emissions units exempt from air permitting are required to be listed at Section II, Subsection C.

Air Construction Permit and Revised/Renewal Title V Air Operation Permit Application – Where this application is used to apply for both an air construction permit and a revised or renewal Title V air operation permit, each emissions unit is classified as either subject to air permitting or exempt from air permitting for air construction permitting purposes, and as regulated, unregulated, or insignificant for Title V air operation permitting purposes. A separate Emissions Unit Information Section (including subsections A through I as required) must be completed for each emissions unit addressed in this application that is subject to air construction permitting and for each such emissions unit that is a regulated or unregulated unit for purposes of Title V permitting. (An emissions unit may be exempt from air construction permitting but still be classified as an unregulated unit for Title V purposes.) Emissions units classified as insignificant for Title V purposes are required to be listed at Section II, Subsection C.

If submitting the application form in hard copy, the number of this Emissions Unit Information Section and the total number of Emissions Unit Information Sections submitted as part of this application must be indicated in the space provided at the top of each page.

EMISSIONS UNIT INFORMATION

Section [1]

18.82 MW SI Internal Combustion Engine

A. GENERAL EMISSIONS UNIT INFORMATION

Title V Air Operation Permit Emissions Unit Classification

Regulated or Unregulated Emissions Unit? (Check one, if applying for an initial, revised or renewal Title V air operation permit. Skip this item if applying for an air construction permit or FESOP only.)

- ☒ The emissions unit addressed in this Emissions Unit Information Section is a regulated emissions unit.
- ☐ The emissions unit addressed in this Emissions Unit Information Section is an unregulated emissions unit.

Emissions Unit Description and Status

1. **Type of Emissions Unit Addressed in this Section** (Check one)

- ☐ This Emissions Unit Information Section addresses, as a single emissions unit, a single process or production unit, or activity, which produces one or more air pollutants and which has at least one definable emission point (stack or vent).
- ☒ This Emissions Unit Information Section addresses, as a single emissions unit, a group of process or production units and activities which has at least one definable emission point (stack or vent) but may also produce fugitive emissions.
- ☐ This Emissions Unit Information Section addresses, as a single emissions unit, one or more process or production units and activities which produce fugitive emissions only.

2. **Description of Emissions Unit Addressed in this Section:**

18.82 MW SI Internal Combustion Engine

3. **Emissions Unit Identification Number:** TBD

4. **Emissions Unit Status Code:**

C

5. **Commence Construction Date:**

June 2019

6. **Initial Startup Date:**

10/2019

7. **Emissions Unit Major Group SIC Code:**

49

8. **NAICS Code:**

9. **Federal Program Applicability:** (Check all that apply)

- ☐ Acid Rain Unit
- ☐ CAIR Unit

10. **Package Unit**

Manufacturer: Wartsila

Model Number: 18V50SG

11. **Generator Nameplate Rating:**

18.82 MW

12. **Emissions Unit Comment:**

One four-stroke spark ignited lean-burn reciprocating internal combustion engine and generator set, which will burn natural gas to generate total 18.82 MW of electricity.

EMISSIONS UNIT INFORMATION

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18.82 MW SI Internal Combustion Engine

Emissions Unit Control Equipment/Method: Control 1 of 2

1. Control Equipment/Method Description:

Selective Catalytic Reduction

2. Control Device or Method Code: 139

Emissions Unit Control Equipment/Method: Control 2 of 2

1. Control Equipment/Method Description:

Catalytic Oxidation

2. Control Device or Method Code: 109

Emissions Unit Control Equipment/Method: Control ____ of ____

1. Control Equipment/Method Description:

2. Control Device or Method Code:

Emissions Unit Control Equipment/Method: Control ____ of ____

1. Control Equipment/Method Description:

2. Control Device or Method Code:

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18.82 MW SI Internal Combustion Engine

Emissions Unit Operating Capacity and Schedule

1. Maximum Process or Throughput Rate:		
2. Maximum Production Rate:		
3. Maximum Heat Input Rate: 161.4 mmBtu/hr (HHV basis)		
4. Maximum Incineration Rate: lbs/hr tons/day		
5. Requested Maximum Operating Schedule		
	24 hours/day:	7 days/week:
	52 weeks/year:	8760 hours/year:
6. Operating Capacity/Schedule Comment:		
See PSD Report.		

EMISSIONS UNIT INFORMATION

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18.82 MW SI Internal Combustion Engine

C. EMISSION POINT (STACK/VENT) INFORMATION

(Optional for unregulated emissions units.)

Emission Point Description and Type

1. Identification of Point on Plot Plan or Flow Diagram: Wartsila Engine 5		2. Emission Point Type Code: 3
3. Descriptions of Emission Points Comprising this Emissions Unit for VE Tracking: Exhausts through a single stack.		
4. ID Numbers or Descriptions of Emission Units with this Emission Point in Common:		
5. Discharge Type Code: V	6. Stack Height (feet): 75	7. Exit Diameter (feet): 5.25
8. Exit Temperature (°F): 684	9. Actual Volumetric Flow Rate (acfm): 122,962	10. Water Vapor (%):
11. Maximum Dry Standard Flow Rate (dscfm):		12. Nonstack Emission Point Height (feet):
13. Emission Point UTM Coordinates Zone: East (km): North (km):		14. Emission Point Latitude/Longitude Latitude (DD/MM/SS): Longitude (DD/MM/SS):
15. Emission Point Comment: See PSD Report.		

EMISSIONS UNIT INFORMATION

Section [1]

18.82 MW SI Internal Combustion Engine

D. SEGMENT (PROCESS/FUEL) INFORMATION**Segment Description and Rate:** Segment 1 of 1

1. Segment Description (Process/Fuel Type): Internal Combustion Engines – Electric Generation; Natural Gas; Reciprocating		
2. Source Classification Code (SCC): 2-01-002-02		3. SCC Units: MM Cubic Feet Burned
4. Maximum Hourly Rate: 0.1582	5. Maximum Annual Rate: 1,384.6	6. Estimated Annual Activity Factor:
7. Maximum % Sulfur:	8. Maximum % Ash:	9. Million Btu per SCC Unit: 1020 (HHV)
10. Segment Comment: Maximum hourly rate = 161.4 MMBtu/hr / 1020 Btu/ft ³ = 0.1582 MMft ³ /hr Maximum annual rate = 0.1582 MMft ³ /hr x 8,760 hr/yr = 1,384.6 MMft ³ /yr		

Segment Description and Rate: Segment _____ of _____

1. Segment Description (Process/Fuel Type):		
2. Source Classification Code (SCC):		3. SCC Units:
4. Maximum Hourly Rate:	5. Maximum Annual Rate:	6. Estimated Annual Activity Factor:
7. Maximum % Sulfur:	8. Maximum % Ash:	9. Million Btu per SCC Unit:
10. Segment Comment:		

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18.82 MW SI Internal Combustion Engine

List of Pollutants Emitted by Emissions Unit

[illegible]

EMISSIONS UNIT INFORMATION

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18.82 MW SI Internal Combustion Engine

POLLUTANT DETAIL INFORMATION

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Particulate Matter - PM10/PM2.5

**F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION –
POTENTIAL, FUGITIVE, AND ACTUAL EMISSIONS**

(Optional for unregulated emissions units.)

Complete a Subsection F1 for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V operation permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

Potential, Estimated Fugitive, and Baseline & Projected Actual Emissions

1. Pollutant Emitted: Particulate Matter - PM10/PM2.5		2. Total Percent Efficiency of Control:	
3. Potential Emissions 3.17 lbs/hour 13.9 tons/year		4. Synthetically-Limited? ☐ Yes ☒ No	
5. Range of Estimated Fugitive Emissions (as applicable): _____ to _____ tons/year			
6. Emission Factor: 3.17 lb/hr; 0.08 g/kW-hr Reference: Design basis		7. Emissions Method Code: 0	
8.a. Baseline Actual Emissions (if required): _____ tons/year		8.b. Baseline 24-month Period: From: _____ To: _____	
9.a. Projected Actual Emissions (if required): _____ tons/year		9.b. Projected Monitoring Period: ☐ 5 years ☐ 10 years	
10. Calculation of Emissions: See PSD Report, Table 2-1 and 2-2			
11. Potential, Fugitive, and Actual Emissions Comment: Potential emissions based on natural gas firing.			

EMISSIONS UNIT INFORMATION

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18.82 MW SI Internal Combustion Engine

POLLUTANT DETAIL INFORMATION

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Particulate Matter - PM10/PM2.5

**F2. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION -
ALLOWABLE EMISSIONS**

Complete Subsection F2 if the pollutant identified in Subsection F1 is or would be subject to a numerical emissions limitation.

Allowable Emissions Numerical Emissions Limitation 1 of 1

1. Basis for Numerical Emissions Limitation Code: OTHER	2. Future Effective Date of Numerical Emissions Limitation:
3. Numerical Emissions Limitation and Units: 10% opacity	4. Equivalent Allowable Emissions: 3.17 lbs/hour 13.9 tons/year
5. Method of Compliance: Annual opacity test using EPA Method 9	
6. Allowable Emissions Comment (Description of Operating Method): Proposed BACT limit	

Allowable Emissions Numerical Emissions Limitation ____ of ____

1. Basis for Numerical Emissions Limitation Code:	2. Future Effective Date of Numerical Emissions Limitation:
3. Numerical Emissions Limitation and Units:	4. Equivalent Allowable Emissions: lbs/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

Allowable Emissions Numerical Emissions Limitation ____ of ____

1. Basis for Numerical Emissions Limitation Code:	2. Future Effective Date of Numerical Emissions Limitation:
3. Numerical Emissions Limitation and Units:	4. Equivalent Allowable Emissions: lbs/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

EMISSIONS UNIT INFORMATION

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18.82 MW SI Internal Combustion Engine

POLLUTANT DETAIL INFORMATION

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Nitrogen Oxides - NOx

**F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION –
POTENTIAL, FUGITIVE, AND ACTUAL EMISSIONS**

(Optional for unregulated emissions units.)

Complete a Subsection F1 for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V operation permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

Potential, Estimated Fugitive, and Baseline & Projected Actual Emissions

1. Pollutant Emitted: NOx		2. Total Percent Efficiency of Control:	
3. Potential Emissions 2.44 lbs/hour 10.69 tons/year		4. Synthetically-Limited? ☐ Yes ☒ No	
5. Range of Estimated Fugitive Emissions (as applicable): _____ to _____ tons/year			
6. Emission Factor: 5 ppmvd @ 15% O₂ Reference: Design basis		7. Emissions Method Code: 2	
8.a. Baseline Actual Emissions (if required): _____ tons/year		8.b. Baseline 24-month Period: From: _____ To: _____	
9.a. Projected Actual Emissions (if required): _____ tons/year		9.b. Projected Monitoring Period: ☐ 5 years ☐ 10 years	
10. Calculation of Emissions: See PSD Report, Table 2-1 and 2-2			
11. Potential, Fugitive, and Actual Emissions Comment: Potential emissions based on natural gas firing.			

EMISSIONS UNIT INFORMATION

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18.82 MW SI Internal Combustion Engine

POLLUTANT DETAIL INFORMATION

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Nitrogen Oxides - NOx

**F2. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION -
ALLOWABLE EMISSIONS**

Complete Subsection F2 if the pollutant identified in Subsection F1 is or would be subject to a numerical emissions limitation.

Allowable Emissions Numerical Emissions Limitation 1 of 2

1. Basis for Numerical Emissions Limitation Code: Rule	2. Future Effective Date of Numerical Emissions Limitation:
3. Numerical Emissions Limitation and Units: 2.44 lb/hr (3-hour average)	4. Equivalent Allowable Emissions: 2.44 lb/hr lbs/hour 10.69 tons/year
5. Method of Compliance: Initial testing each engine using EPA Method 7 or 7E; annual testing of one engine	
6. Allowable Emissions Comment (Description of Operating Method):	

Allowable Emissions Numerical Emissions Limitation 2 of 2

1. Basis for Numerical Emissions Limitation Code: Rule	2. Future Effective Date of Numerical Emissions Limitation:
3. Numerical Emissions Limitation and Units: 1.0 g/bhp-hr (3-hour average)	4. Equivalent Allowable Emissions: 40.0 lbs/hour 175.3 tons/year
5. Method of Compliance: Pursuant to 40 CFR 60.4243(b)(2)(ii) (Initial testing and every 8,760 hours operation or 3 years, whichever comes first.)	
6. Allowable Emissions Comment (Description of Operating Method): 40 CFR Part 60 Subpart JJJJ limit. Allowable emissions are based on Permit No. 0730003-015-AC/PSD-FL-441	

Allowable Emissions Numerical Emissions Limitation _____ of _____

1. Basis for Numerical Emissions Limitation Code:	2. Future Effective Date of Numerical Emissions Limitation:
3. Numerical Emissions Limitation and Units:	4. Equivalent Allowable Emissions: lbs/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

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18.82 MW SI Internal Combustion Engine

POLLUTANT DETAIL INFORMATION

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Carbon Monoxide - CO

**F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION –
POTENTIAL, FUGITIVE, AND ACTUAL EMISSIONS**

(Optional for unregulated emissions units.)

Complete a Subsection F1 for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V operation permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

Potential, Estimated Fugitive, and Baseline & Projected Actual Emissions

1. Pollutant Emitted: Carbon Monoxide- CO		2. Total Percent Efficiency of Control:	
3. Potential Emissions 4.96 lbs/hour 21.7 tons/year		4. Synthetically-Limited? ☐ Yes ☒ No	
5. Range of Estimated Fugitive Emissions (as applicable): _____ to _____ tons/year			
6. Emission Factor: 15 ppmvd @ 15% O2 Reference: Design basis		7. Emissions Method Code: 2	
8.a. Baseline Actual Emissions (if required): _____ tons/year		8.b. Baseline 24-month Period: From: _____ To: _____	
9.a. Projected Actual Emissions (if required): _____ tons/year		9.b. Projected Monitoring Period: ☐ 5 years ☐ 10 years	
10. Calculation of Emissions: See PSD Report, Table 2-1 and 2-2			
11. Potential, Fugitive, and Actual Emissions Comment: Potential emissions based on natural gas firing.			

EMISSIONS UNIT INFORMATION

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18.82 MW SI Internal Combustion Engine

POLLUTANT DETAIL INFORMATION

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Carbon Monoxide - CO

**F2. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION -
ALLOWABLE EMISSIONS**

Complete Subsection F2 if the pollutant identified in Subsection F1 is or would be subject to a numerical emissions limitation.

Allowable Emissions Numerical Emissions Limitation 1 of 1

1. Basis for Numerical Emissions Limitation Code: OTHER	2. Future Effective Date of Numerical Emissions Limitation:
3. Numerical Emissions Limitation and Units: 4.96 lb/hr (3-Hour average)	4. Equivalent Allowable Emissions: 4.96 lbs/hour 21.7 tons/year
5. Method of Compliance: Initial test of each using EPA Method 10; annual test on one engine	
6. Allowable Emissions Comment (Description of Operating Method): Based on design basis of 15ppmvd @15%O2	

Allowable Emissions Numerical Emissions Limitation ____ of ____

1. Basis for Numerical Emissions Limitation Code:	2. Future Effective Date of Numerical Emissions Limitation:
3. Numerical Emissions Limitation and Units:	4. Equivalent Allowable Emissions: lbs/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

Allowable Emissions Numerical Emissions Limitation ____ of ____

1. Basis for Numerical Emissions Limitation Code:	2. Future Effective Date of Numerical Emissions Limitation:
3. Numerical Emissions Limitation and Units:	4. Equivalent Allowable Emissions: lbs/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

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18.82 MW SI Internal Combustion Engine

POLLUTANT DETAIL INFORMATION

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Volatile Organic Compounds

**F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION –
POTENTIAL, FUGITIVE, AND ACTUAL EMISSIONS**

(Optional for unregulated emissions units.)

Complete a Subsection F1 for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V operation permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

Potential, Estimated Fugitive, and Baseline & Projected Actual Emissions

1. Pollutant Emitted: Volatile Organic Compounds - VOC		2. Total Percent Efficiency of Control:	
3. Potential Emissions 4.92 lbs/hour 21.5 tons/year		4. Synthetically-Limited? ☐ Yes ☒ No	
5. Range of Estimated Fugitive Emissions (as applicable): _____ to _____ tons/year			
6. Emission Factor: 26 ppmvd @ 15% O ₂ as CH ₄ Reference: Design basis		7. Emissions Method Code: 2	
8.a. Baseline Actual Emissions (if required): _____ tons/year		8.b. Baseline 24-month Period: From: _____ To: _____	
9.a. Projected Actual Emissions (if required): _____ tons/year		9.b. Projected Monitoring Period: ☐ 5 years ☐ 10 years	
10. Calculation of Emissions: See PSD Report, Table 2-1 and 2-2			
11. Potential, Fugitive, and Actual Emissions Comment: Potential emissions based on natural gas firing.			

EMISSIONS UNIT INFORMATION

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18.82 MW SI Internal Combustion Engine

POLLUTANT DETAIL INFORMATION

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Volatile Organic Compounds

**F2. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION -
ALLOWABLE EMISSIONS**

Complete Subsection F2 if the pollutant identified in Subsection F1 is or would be subject to a numerical emissions limitation.

Allowable Emissions Numerical Emissions Limitation 1 of 2

1. Basis for Numerical Emissions Limitation Code: Other	2. Future Effective Date of Numerical Emissions Limitation:
3. Numerical Emissions Limitation and Units: 4.92 lb/hr	4. Equivalent Allowable Emissions: 4.92 lbs/hour 21.5 tons/year
5. Method of Compliance: Initial test of each using EPA Method 18; compliance with CO limits	
6. Allowable Emissions Comment (Description of Operating Method): Proposed BACT Limit of 26 ppmvd @15% O2 for 70-100% load range	

Allowable Emissions Numerical Emissions Limitation 2 of 2

1. Basis for Numerical Emissions Limitation Code: Rule	2. Future Effective Date of Numerical Emissions Limitation:
3. Numerical Emissions Limitation and Units: 0.7 g/bhp-hr	4. Equivalent Allowable Emissions: 21.5 lbs/hour 94.3 tons/year
5. Method of Compliance: Pursuant to 40 CFR 60.4243(b)(2)(ii) (Initial testing and every 8,760 hours operation or 3 years, whichever comes first.)	
6. Allowable Emissions Comment (Description of Operating Method): 40 CFR Part 60 Subpart JJJJ limit. Allowable emissions based on permit No. 0730003-15-AC/PSD-FL-441	

Allowable Emissions Numerical Emissions Limitation ____ of ____

1. Basis for Numerical Emissions Limitation Code:	2. Future Effective Date of Numerical Emissions Limitation:
3. Numerical Emissions Limitation and Units:	4. Equivalent Allowable Emissions: lbs/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

EMISSIONS UNIT INFORMATION

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18.82 MW SI Internal Combustion Engine

POLLUTANT DETAIL INFORMATION

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Sulfur Dioxide - SO₂**F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION –
POTENTIAL, FUGITIVE, AND ACTUAL EMISSIONS**

(Optional for unregulated emissions units.)

Complete a Subsection F1 for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V operation permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

Potential, Estimated Fugitive, and Baseline & Projected Actual Emissions

1. Pollutant Emitted: Sulfur Dioxide - SO ₂		2. Total Percent Efficiency of Control:	
3. Potential Emissions 0.875 lbs/hour 3.83 tons/year		4. Synthetically-Limited? ☐ Yes ☒ No	
5. Range of Estimated Fugitive Emissions (as applicable): _____ to _____ tons/year			
6. Emission Factor: 2 grains S/100 scf Reference: Sulfur Content of natural gas		7. Emissions Method Code: 2	
8.a. Baseline Actual Emissions (if required): _____ tons/year		8.b. Baseline 24-month Period: From: _____ To: _____	
9.a. Projected Actual Emissions (if required): _____ tons/year		9.b. Projected Monitoring Period: ☐ 5 years ☐ 10 years	
10. Calculation of Emissions: See PSD Report, Table 2-1 and 2-2			
11. Potential, Fugitive, and Actual Emissions Comment: Potential emissions based on natural gas firing.			

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18.82 MW SI Internal Combustion Engine

POLLUTANT DETAIL INFORMATION

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Sulfur Dioxide - SO₂

**F2. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION -
ALLOWABLE EMISSIONS**

Complete Subsection F2 if the pollutant identified in Subsection F1 is or would be subject to a numerical emissions limitation.

Allowable Emissions Numerical Emissions Limitation 1 of 1

1. Basis for Numerical Emissions Limitation Code: Other	2. Future Effective Date of Numerical Emissions Limitation:
3. Numerical Emissions Limitation and Units: Fuel Sulfur limit 2gr/100 scf	4. Equivalent Allowable Emissions: 0.875 lbs/hour 3.83 tons/year
5. Method of Compliance: None	
6. Allowable Emissions Comment (Description of Operating Method): Allowable emissions based on permit No. 0730003-015-AC/PSD-FL-441	

Allowable Emissions Numerical Emissions Limitation ____ of ____

1. Basis for Numerical Emissions Limitation Code:	2. Future Effective Date of Numerical Emissions Limitation:
3. Numerical Emissions Limitation and Units:	4. Equivalent Allowable Emissions: lbs/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

Allowable Emissions Numerical Emissions Limitation ____ of ____

1. Basis for Numerical Emissions Limitation Code:	2. Future Effective Date of Numerical Emissions Limitation:
3. Numerical Emissions Limitation and Units:	4. Equivalent Allowable Emissions: lbs/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

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18.82 MW SI Internal Combustion Engine

POLLUTANT DETAIL INFORMATION

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Formaldehyde H095

**F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION –
POTENTIAL, FUGITIVE, AND ACTUAL EMISSIONS****(Optional for unregulated emissions units.)**

Complete a Subsection F1 for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V operation permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

Potential, Estimated Fugitive, and Baseline & Projected Actual Emissions

1. Pollutant Emitted: Formaldehyde- H095		2. Total Percent Efficiency of Control:	
3. Potential Emissions 5.0 lbs/hour 21.9 tons/year		4. Synthetically-Limited? ☐ Yes ☒ No	
5. Range of Estimated Fugitive Emissions (as applicable): _____ to _____ tons/year			
6. Emission Factor: 14 ppmvd @15% O₂ Reference: NESHAPS Subpart ZZZZ		7. Emissions Method Code: 2	
8.a. Baseline Actual Emissions (if required): _____ tons/year		8.b. Baseline 24-month Period: From: _____ To: _____	
9.a. Projected Actual Emissions (if required): _____ tons/year		9.b. Projected Monitoring Period: ☐ 5 years ☐ 10 years	
10. Calculation of Emissions: See PSD Report, Table 2-1 and 2-2			
11. Potential, Fugitive, and Actual Emissions Comment: Potential emissions based on natural gas firing.			

EMISSIONS UNIT INFORMATION

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18.82 MW SI Internal Combustion Engine

POLLUTANT DETAIL INFORMATIONPage [6] of [7]
Formaldehyde H095**F2. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION -
ALLOWABLE EMISSIONS**

Complete Subsection F2 if the pollutant identified in Subsection F1 is or would be subject to a numerical emissions limitation.

Allowable Emissions Numerical Emissions Limitation 1 of 1

1. Basis for Numerical Emissions Limitation Code: Rule	2. Future Effective Date of Numerical Emissions Limitation:
3. Numerical Emissions Limitation and Units: 14 ppmvd @ 15% O ₂	4. Equivalent Allowable Emissions: lbs/hour tons/year
5. Method of Compliance: Methods 320 or 323; or reduction of CO emissions, Table 3 to Subpart ZZZZ	
6. Allowable Emissions Comment (Description of Operating Method): NESHAPS Subpart ZZZZ emission limit.	

Allowable Emissions Numerical Emissions Limitation ____ of ____

1. Basis for Numerical Emissions Limitation Code:	2. Future Effective Date of Numerical Emissions Limitation:
3. Numerical Emissions Limitation and Units:	4. Equivalent Allowable Emissions: lbs/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

Allowable Emissions Numerical Emissions Limitation ____ of ____

1. Basis for Numerical Emissions Limitation Code:	2. Future Effective Date of Numerical Emissions Limitation:
3. Numerical Emissions Limitation and Units:	4. Equivalent Allowable Emissions: lbs/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

EMISSIONS UNIT INFORMATION

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18.82 MW SI Internal Combustion Engine

POLLUTANT DETAIL INFORMATION

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Sulfuric Acid Mist - SAM

**F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION –
POTENTIAL, FUGITIVE, AND ACTUAL EMISSIONS**

(Optional for unregulated emissions units.)

Complete a Subsection F1 for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V operation permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

Potential, Estimated Fugitive, and Baseline & Projected Actual Emissions

1. Pollutant Emitted: Sulfuric Acid Mist - SAM		2. Total Percent Efficiency of Control:	
3. Potential Emissions 0.134 lbs/hour 0.59 tons/year		4. Synthetically-Limited? ☐ Yes ☒ No	
5. Range of Estimated Fugitive Emissions (as applicable): _____ to _____ tons/year			
6. Emission Factor: 2 grains S/100 scf Reference: Sulfur Content of natural gas		7. Emissions Method Code: 0	
8.a. Baseline Actual Emissions (if required): _____ tons/year		8.b. Baseline 24-month Period: From: _____ To: _____	
9.a. Projected Actual Emissions (if required): _____ tons/year		9.b. Projected Monitoring Period: ☐ 5 years ☐ 10 years	
10. Calculation of Emissions: See PSD Report, Table 2-1 and 2-2			
11. Potential, Fugitive, and Actual Emissions Comment: Potential emissions based on natural gas firing.			

EMISSIONS UNIT INFORMATION

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18.82 MW SI Internal Combustion Engine

POLLUTANT DETAIL INFORMATION

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Sulfuric Acid Mist - SAM

**F2. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION -
ALLOWABLE EMISSIONS**

Complete Subsection F2 if the pollutant identified in Subsection F1 is or would be subject to a numerical emissions limitation.

Allowable Emissions Numerical Emissions Limitation 1 of 1

1. Basis for Numerical Emissions Limitation Code: Other	2. Future Effective Date of Numerical Emissions Limitation:
3. Numerical Emissions Limitation and Units: Fuel sulfur limit 2gr/100 scf	4. Equivalent Allowable Emissions: lbs/hour tons/year
5. Method of Compliance: None	
6. Allowable Emissions Comment (Description of Operating Method):	

Allowable Emissions Numerical Emissions Limitation ____ of ____

1. Basis for Numerical Emissions Limitation Code:	2. Future Effective Date of Numerical Emissions Limitation:
3. Numerical Emissions Limitation and Units:	4. Equivalent Allowable Emissions: lbs/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

Allowable Emissions Numerical Emissions Limitation ____ of ____

1. Basis for Numerical Emissions Limitation Code:	2. Future Effective Date of Numerical Emissions Limitation:
3. Numerical Emissions Limitation and Units:	4. Equivalent Allowable Emissions: lbs/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

EMISSIONS UNIT INFORMATION

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18.82 MW SI Internal Combustion Engine

POLLUTANT DETAIL INFORMATION

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Greenhouse Gas (GHG)

**F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION –
POTENTIAL, FUGITIVE, AND ACTUAL EMISSIONS****(Optional for unregulated emissions units.)**

Complete a Subsection F1 for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V operation permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

Potential, Estimated Fugitive, and Baseline & Projected Actual Emissions

1. Pollutant Emitted: Greenhouse Gas - GHG		2. Total Percent Efficiency of Control:	
3. Potential Emissions lbs/hour 84,105 tons/year		4. Synthetically-Limited? ☐ Yes ☒ No	
5. Range of Estimated Fugitive Emissions (as applicable): _____ to _____ tons/year			
6. Emission Factor: See Table A-4 in PSD Report Reference: 40 CFR Parts 75 and 98			7. Emissions Method Code: 2
8.a. Baseline Actual Emissions (if required): tons/year		8.b. Baseline 24-month Period: From: To:	
9.a. Projected Actual Emissions (if required): tons/year		9.b. Projected Monitoring Period: ☐ 5 years ☐ 10 years	
10. Calculation of Emissions: Refer to Table A-4 in PSD Report			
11. Potential, Fugitive, and Actual Emissions Comment:			

EMISSIONS UNIT INFORMATION

Section [1]
18.82 MW SI Internal Combustion Engine

POLLUTANT DETAIL INFORMATION

Page [1] of [7]
Greenhouse Gas (GHG)

**F2. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION -
ALLOWABLE EMISSIONS**

Complete Subsection F2 if the pollutant identified in Subsection F1 is or would be subject to a numerical emissions limitation.

Allowable Emissions Numerical Emissions Limitation 1 of 1

1. Basis for Numerical Emissions Limitation Code: OTHER	2. Future Effective Date of Numerical Emissions Limitation:
3. Numerical Emissions Limitation and Units: 1,110 lb CO₂e/MWh (Gross)	4. Equivalent Allowable Emissions: lbs/hour 84,105 tons/year
5. Method of Compliance: 12-month rolling average	
6. Allowable Emissions Comment (Description of Operating Method): Allowable emissions based on BACT limit in Permit No.0730003-015-AC/PSD-FL-441	

Allowable Emissions Numerical Emissions Limitation ____ of ____

1. Basis for Numerical Emissions Limitation Code:	2. Future Effective Date of Numerical Emissions Limitation:
3. Numerical Emissions Limitation and Units:	4. Equivalent Allowable Emissions: lbs/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

Allowable Emissions Numerical Emissions Limitation ____ of ____

1. Basis for Numerical Emissions Limitation Code:	2. Future Effective Date of Numerical Emissions Limitation:
3. Numerical Emissions Limitation and Units:	4. Equivalent Allowable Emissions: lbs/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

EMISSIONS UNIT INFORMATION

Section [1]

18.82 MW SI Internal Combustion Engine

G. VISIBLE EMISSIONS INFORMATION

Complete Subsection G if this emissions unit is or would be subject to a unit-specific visible emissions limitation.

Visible Emissions Limitation: Visible Emissions Limitation 1 of 2

1. Visible Emissions Subtype: VE20	2. Basis for Opacity Limit: ☒ Rule ☐ Other
3. Opacity Limit Normal Conditions: 20 % Exceptional Conditions: 100 % Maximum Period of Excess Opacity Allowed: min/hour	
4. Method of Compliance: EPA Method 9	
5. Visible Emissions Comment: FDEP Rule 62-296.320(4)(b)1, F.A.C., requires 20 percent opacity. Excess emissions allowed for 2 hours in any 24-hr period (Rule 62-210.700(1)).	

Visible Emissions Limitation: Visible Emissions Limitation 2 of 2

1. Visible Emissions Subtype: VE10	2. Basis for Opacity Limit: ☐ Rule ☒ Other
3. Opacity Limit Normal Conditions: 10 % Exceptional Conditions: 20 % Maximum Period of Excess Opacity Allowed: 6 min/hour	
4. Method of Compliance: EPA Method 9	
5. Visible Emissions Comment:	

EMISSIONS UNIT INFORMATION

Section [1]

18.82 MW SI Internal Combustion Engine

H. CONTINUOUS MONITOR INFORMATION

Complete Subsection H if this emissions unit is or would be subject to continuous monitoring.

Continuous Monitoring System: Continuous Monitor ____ of ____

1. Parameter Code:	2. Pollutant(s):
3. CMS Requirement:	
4. Monitor Manufacturer: Model Number:	Serial Number:
5. Installation Date:	6. Performance Specification Test Date:
7. Continuous Monitor Comment:	

Continuous Monitoring System: Continuous Monitor ____ of ____

1. Parameter Code:	2. Pollutant(s):
3. CMS Requirement:	
4. Monitor Manufacturer: Model Number:	Serial Number:
5. Installation Date:	6. Performance Specification Test Date:
7. Continuous Monitor Comment:	

EMISSIONS UNIT INFORMATION

Section [1]

18.82 MW SI Internal Combustion Engine

I. EMISSIONS UNIT ADDITIONAL INFORMATION

Additional Requirements for All Applications, Except as Otherwise Stated

1. Process Flow Diagram (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought) ☒ Attached, Document ID: COT-EU1-I1 ☐ Previously Submitted, Date _____
2. Fuel Analysis or Specification (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought) ☒ Attached, Document ID: See PSD Report ☐ Previously Submitted, Date _____
3. Detailed Description of Control Equipment (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought) ☒ Attached, Document ID: See PSD Report ☐ Previously Submitted, Date _____
4. Procedures for Startup and Shutdown (Required for all operation permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought) ☐ Attached, Document ID: _____ ☐ Previously Submitted, Date _____ ☒ Not Applicable (construction application)
5. Operation and Maintenance Plan (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought) ☐ Attached, Document ID: _____ ☐ Previously Submitted, Date _____ ☒ Not Applicable
6. Compliance Demonstration Reports/Records ☐ Attached, Document ID: _____ Test Date(s)/Pollutant(s) Tested: _____ _____ ☐ Previously Submitted, Date: _____ Test Date(s)/Pollutant(s) Tested: _____ ☐ To be Submitted, Date (if known): _____ Test Date(s)/Pollutant(s) Tested: _____ ☒ Not Applicable Note: For FESOP applications, all required compliance demonstration records/reports must be submitted at the time of application. For Title V air operation permit applications, all required compliance demonstration reports/records must be submitted at the time of application, or a compliance plan must be submitted at the time of application.
7. Other Information Required by Rule or Statute ☒ Attached, Document ID: See PSD Report ☐ Not Applicable

18.82 MW SI Internal Combustion Engine

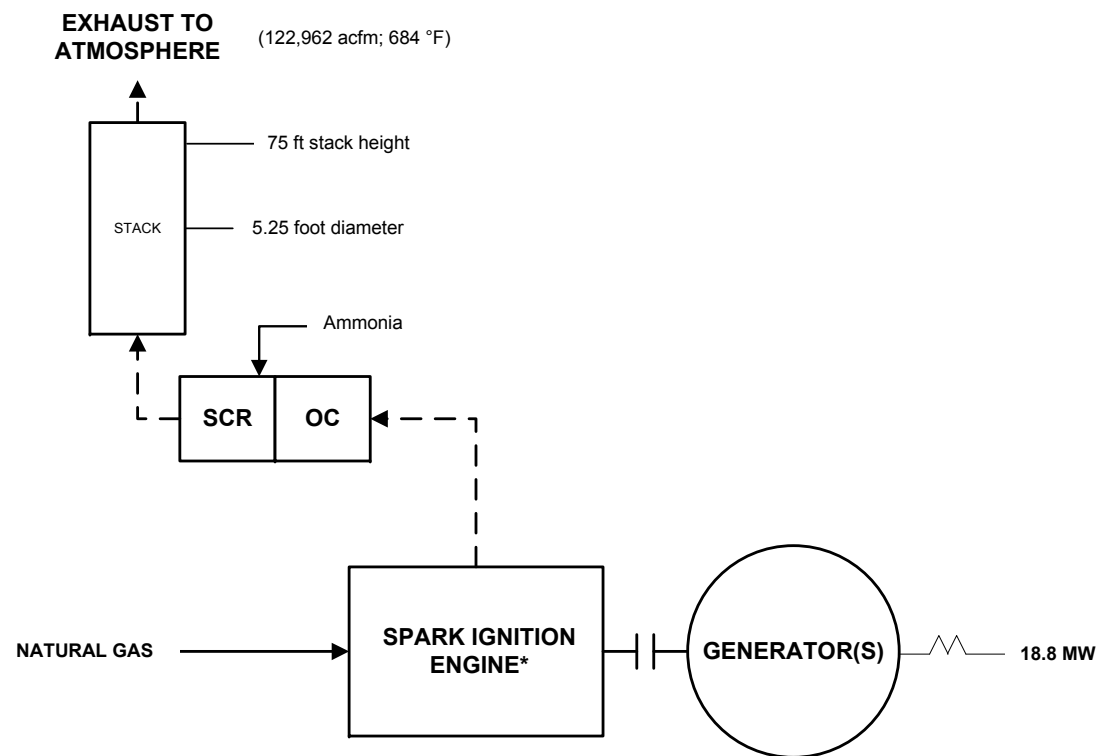
Additional Requirements for Air Construction Permit Applications

1.	Control Technology Review and Analysis (Rules 62-212.400(10) and 62-212.500(7), F.A.C.; 40 CFR 63.43(d) and (e))	☒ Attached, Document ID: <u>See PSD Report</u>	☐ Not Applicable
2.	Good Engineering Practice Stack Height Analysis (Rules 62-212.400(4)(d) and 62-212.500(4)(f), F.A.C.)	☒ Attached, Document ID: <u>See PSD Report</u>	☐ Not Applicable
3.	Description of Stack Sampling Facilities (Required for proposed new stack sampling facilities only)	☐ Attached, Document ID: _____	☒ Not Applicable

1. Identification of Applicable Requirements (For federal regulations where applicability is dependent on the specific type of emissions unit and/or emissions unit subgroup, provide the level of detail required to determine which specific set of regulations apply.): ☐ Attached, Document ID: _____
2. Compliance Assurance Monitoring ☐ Attached, Document ID: _____ ☒ Not Applicable
3. Alternative Methods of Operation ☐ Attached, Document ID: _____ ☐ Not Applicable
4. Alternative Modes of Operation (Emissions Trading) ☐ Attached, Document ID: _____ ☒ Not Applicable

[illegible]

ATTACHMENT COT-EU1-I1
PROCESS FLOW DIAGRAM



*The engine is four-stroke lean-burn gas fired reciprocating engine.

Process Flow Legend

Solid/Liquid	————→
Gas	- - - - ->
Steam	- - - - ->



Appendix B

Stormwater Analysis

HOPKINS ELECTRIC PLANT RICE PROJECT

MBC Job No. R83.001/2016-304

Downstream Conveyance Stormwater Analysis

Date: December 14, 2018

Roger V. Wynn, P.E., #49400



805 North Gadsden Street - Tallahassee, Florida 32303 - (850) 222-5678
Certificate of Authorization No. 00006108

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1. Narrative and Discussion



Land Use Planning • Engineering Design • Environmental Permitting • Landscape Architecture • Surveying

**Stormwater Narrative
for
Hopkins Electric Power Generating Plant
Reliability R.I.C.E. Project**

MBC Job No. R83.002

December 14, 2018

GENERAL

The Hopkins Electric Power Generating Plant is located on the east side of Geddie Road approximately ½ mile north of Highway 20 in western Leon County.

In 2017 and 2018 the City of Tallahassee Electric Department constructed four (4) a natural gas-fired Reciprocating Internal Combustion Engine (R.I.C.E) generators to enhance power generation and reliability during peak demand periods. While the original plan proposed five (5) engines total, only four (4) were constructed. The fifth engine is proposed for construction with this plan as well as a 2500 sf concrete pad for construction of proposed radiators.

The project area falls within the Lake Munson Drainage Basin and within the Gum Creek West Watershed.

PRESENT CONDITION

The project area is currently developed, and as indicated in the 2017 drainage report, the study area was divided into an eastern and western basin. The majority of the currently proposed development falls in the western basin with the addition of the radiator pad proposed to the eastern basin. See Survey of Project Area, Sheet 1.0 and Existing Conditions Map, Sheet 2.0.

The stormwater model prepared in 2017, for the original plan, included the construction of all five (5) engines, but only four (4) were built in the initial construction phase. As stated above, the fifth engine is proposed for construction currently.

The previous drainage study also proposed modifications to the existing stormwater facility including filling in a portion of the pond along the northwestern bank for proposed construction of a perimeter maintenance road. The proposed modifications to the pond were not completed and the perimeter maintenance road has been eliminated from the plan.

PURPOSE AND PROPOSED CONDITION

The purpose of this study is to determine the modifications to the pond, necessary to complete build out of the improvements in the western basin including construction of the fifth RICE generator and the eastern basin including the concrete pad supporting the proposed radiators, while eliminating the proposed encroachment of the perimeter maintenance road.

This analysis is based on the ICPR model developed in the 2017 drainage report and study (See Hopkins Electric Power Generating Plant Reliability RICE Project, dated March 28, 2017, MBC Job No. R83.001).

As stated in the 2017 report, the improvements proposed for the R.I.C.E. project add approximately 1.087 acres of impervious area and approximately 0.635 acres of gravel (aggregate) area to the western basin. 2500 sf of impervious area (.06 acres) has been added to the eastern basin for the additional of the concrete pad.

PROPOSED POND MODIFICATIONS

The top of berm of the existing pond varies between elevation 130.5 and 131.8. The berm will be raised to a minimum elevation of 131.3. The existing outfall structure consists of a storm drain inlet with a baffle wall in the middle of the structure and a 4-inch orifice through the baffle wall. The baffle wall acts as an overflow weir inside of the inlet. Flow from the pond is conveyed to the outfall structure through a 12-inch PVC pipe. After passing through the 4-inch orifice or over the baffle wall, flow exits the outfall structure, also through a 12-inch PVC pipe. No change is proposed to this structure and pipe conveyance.

A large spillway, lined with boulders, is cut into the berm. This spillway will be raised from an approximate elevation of 128.0 to elevation 129.75. No change is proposed to the stage storage data of the existing SWMF. See sheets 4.0 and 4.1 for details on the modifications to the berm and spillway.

OFFSITE DOWNSTREAM CONVEYANCE ANALYSIS

Generally, as stormwater runoff leaves the site it flows to the south and east through a natural water course, eventually crossing Barineau Road through a 7.7 foot wide by 4 foot high box culvert. The boundary condition for this analysis was set at Barineau Road. The total drainage area to Barineau Road is approximately 344 acres. This is divided into a North Basin of 124 acres, and a South Basin of 219 acres. The North Basin drains to a railroad with a 42-inch RCP culvert. This culvert discharges into a natural watercourse and then merges with the watercourse that leads to the Barineau Road box culvert. See Overall Drainage Basin Map, sheet 3.0.

No changes were made to the offsite drainage parameters from the previous model.

RESULTS

Onsite

The existing stormwater management facility with the modifications proposed provides attenuation for the 2-year through 25-year frequency storms, for the 1-hour through 24-hour durations. In addition, one foot of freeboard is provided between the 100-year highwater and the top of the pond berm. See ICPR Results Summary.

The 25-year highwater in the pond is 129.76. The 100-year highwater in the pond is 130.12.

Offsite

No significant restrictions or flooding concerns were found in the downstream, conveyance analysis. The box culvert at Barineau Road was examined in the pre and post condition. Pre stages were for the most part are within a few tenths of the post stages. The 100-year highwater (8-hour duration) is 97.31, not rising to the crown of the culvert, and maintaining approximately 4.5 feet of freeboard below the low in Barineau Road.

CONCLUSION

The pond, with the proposed modifications, provides adequate attenuation to meet the requirements of the Leon County Land Development Code and the Northwest Florida Water Management District. The downstream conveyance analysis demonstrates that the proposed project does not cause or exacerbate any flooding problems to the point of analysis at the Barineau Road box culvert.

2. Curve Number & Time of Concentration Calculations



Job Name: HOPKINS ELECTRIC PLANT
 Job No.: R83.001
 Compiled by: JMoore

Date: 4/5/2017
 Rev: 11/27/2018

CN Calculations

Pre-Development

SOIL TYPE: **NCRS Soil Map**
 1 - ALBANY LOAMY SAND TYPE A / D S 32.60%
 5 - BLANTON - TYPE A SOIL GROUP 67.40%

E-Sub-Basin East (Pre-Development)

Total Area 2.14
 Curve Number (modified)

*Cover Desc.	CN	Area	CN * Area
Woods (Poor)	45	2.140	96.30
		2.14	96.30

Curve Number (modified) = 45.0
 Area = 2.14 acres
 DCIA = 0.0%
 Tc = 28.2 minutes

E-Sub-Basin West (Present Conditions)

Total Area 4.92
 Curve Number (modified)

**Cover Desc.	CN	Area	CN * Area
Existing Imprev. (Bldgs, Conc. Misc.)	98	0.950	93.14
Green Developed Areas (Mix of Gravel & Grass)	81	2.843	230.26
Existing SWMF	100	1.127	112.69
		4.92	436.09

Curve Number (modified) = 88.6
 Area = 4.92 acres
 DCIA = 0.0%
 Tc = 5.0 minutes

* Condition of Basin prior to construction of existing pond.
 ** Condition of Basin currently and at construction of existing pond.



Job Name: HOPKINS ELECTRIC PLANT
 Job No.: R83.001
 Compiled by: JMoore

Date: 4/5/2017
 Rev: 12/14/2018

CN Calculations

Post-Development

SOIL TYPE: **NCRS Soil Map**
 1 - ALBANY LOAMY SAND TYPE A / D S 32.60%
 5 - BLANTON - TYPE A SOIL GROUP 67.40%

E-Sub-Basin East (Post)

Total Area 2.14
 Curve Number (modified)

Cover Desc.	CN	Area	CN * Area
Existing Imperv. (Bldgs, Conc. Misc.)	98	1.686	165.21
Green Developed Areas (Mix of Gravel & Grass)	81	0.454	36.79
		2.14	202.00

Curve Number (modified) = 94.4
 Area = 2.14 acres
 DCIA = 0.0%
 Tc = 5.0 minutes

P-Sub-Basin West (Post)

Total Area 4.92
 Curve Number (modified)

Cover Desc.	CN	Area	CN * Area
Total Post Development Impervious Area	98	2.037	199.63
Proposed Aggregate (Gravel)	93	0.635	59.07
Green Developed Areas (Mix of Gravel & Grass)	81	1.442	116.77
Existing SWMF (Reduced)	100	0.806	80.62
		4.92	456.09

Curve Number (modified) = 92.7
 Area = 4.92 acres
 DCIA = 0.0%
 Tc = 5.0 minutes



Job Name: HOPKINS ELECTRIC PLANT
 Job No.: R83.001
 Compiled by: JM

Date: 3/27/2017
 Rev: _____

CN Calculations

Downstream Analysis

SOIL TYPE:	NCRS Soil Map	Type Soil Group	
1	Albany loamy sand	A /D	31.60%
3	Alpin sand	A	20.30%
5	Blanton fine sand	A	35.20%
8	Chipley fine sand	A	4.00%
32	Ocilla fine sand	B/D	1.70%
37	Ortega sand	A	2.20%
38	Pamlico-Dorovan	B/D	4.30%

Sub-Basin: E-Bethel Church Rd

Total Area 31.48
 Curve Number (modified)

Cover Desc.	CN	Area	CN * Area
Ex. Residential (Bldgs, Misc.) 50% Imperv.	69	1.63	112.47
Imperv. (Streets, Roads)	98	1.09	106.82
Pasture (Poor)	68	1.23	83.64
Woods (Good)	25	25.19	629.75
Existing SWMF	100	2.34	234.00
		31.48	1,166.68

Curve Number (modified) = 37.1
 Area = 31.48 acres
 DCIA = 0.0%
 Tc = 10.0 minutes

Sub-Basin: D-3

Total Area 92.77
 Curve Number (modified)

Cover Desc.	CN	Area	CN * Area
Ex. Residential (Bldgs, Misc.) 50% Imperv.	69	29.36	2,025.84
Imperv. (Streets, Roads)	98	1.54	150.92
Pasture (Poor)	68	13.66	928.88
Woods (Good)	25	46.42	1,160.39
Existing Pond Depressions	100	1.79	179.00
		92.77	4,445.03

Curve Number (modified) = 47.9
 Area = 92.77 acres
 DCIA = 0.0%
 Tc = 32.0 minutes



Job Name: HOPKINS ELECTRIC PLANT
 Job No.: R83.001
 Compiled by: JM

Date: 3/27/2017
 Rev: _____

CN Calculations

Downstream Analysis

Sub-Basin: Confluence

Total Area 23.28
 Curve Number (modified)

Cover Desc.	CN	Area	CN * Area
Imperv. (Rail Road)	98	0.38	37.24
Pasture (Fair)	49	1.02	49.98
Woods (Fair)	36	4.35	156.60
Woods (Good)	25	17.53	438.29
		23.28	682.11

Curve Number (modified) = 29.3
 Area = 23.28 acres
 DCIA = 0.0%
 Tc = 33 minutes

Sub-Basin: Transmission Rd

Total Area 67.11
 Curve Number (modified)

Cover Desc.	CN	Area	CN * Area
Ex. (Bldgs, Misc.) 50% Imperv.	69	5.59	385.45
Imperv. (Streets, Roads)	98	0.12	11.76
Pasture (Fair)	49	3.68	180.32
Pasture (Poor)	68	5.71	388.28
Woods (Good)	25	52.01	1,300.26
		67.11	2,266.08

Curve Number (modified) = 33.8
 Area = 67.11 acres
 DCIA = 0.0%
 Tc = 44 minutes

Sub-Basin: B-2

Total Area 83.66
 Curve Number (modified)

Cover Desc.	CN	Area	CN * Area
Existing Open Areas (Industrial Areas)	93	5.63	523.59
Ex. Residential (Bldgs, Misc.) 50% Imperv.	69	1.31	90.39
Imperv. (Streets, Roads)	98	0.54	53.29
Bypass Ditch	39	0.89	34.71
Pasture (Fair)	49	5.36	262.64
Pasture (Poor)	68	0.56	38.08
Woods (Good)	25	69.37	1,734.17
		83.66	2,736.87

Curve Number (modified) = 32.7
 Area = 83.66 acres
 DCIA = 0.0%
 Tc = 42 minutes



Job Name: HOPKINS ELECTRIC PLANT
Job No.: R83.001
Compiled by: JM

Date: 3/27/2017
Rev: _____

CN Calculations

Downstream Analysis

Sub-Basin: Barineau Rd

Total Area 38.94

Curve Number (modified)

Cover Desc.	CN	Area	CN * Area
Ex. Residential (Bldgs, Misc.) 50% Imperv.	69	0.00	0.00
Imperv. (Streets, Roads)	98	0.63	61.74
Pasture (Fair)	49	1.93	94.57
Woods (Fair)	36	5.76	207.36
Woods (Good)	25	30.62	765.59
		38.94	1,129.26

Curve Number (modified) = 29.0
Area = 38.94 acres
DCIA = 0.0%
Tc = 30 minutes

3. SWMF Stage Storage Table Comparison



Project Name: HOPKINS ELECTRIC PLANT

Project No.: R83.001

Prepared By: JM Date: 3/27/2017

Revised By: LH Rev.: 11/27/2018

Checked By: _____ Date: _____

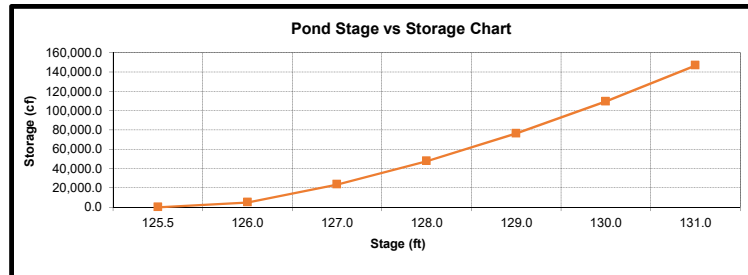
Calculations

Input Parameters

EXISTING SWMF STAGE STORAGE TABLE

SWMF 1

Stage (feet)	Area (sf)	Area (ac)	Inc. Vol. (cf)	Sum Vol. (cf)	Sum Vol. (af)
125.5	5,005	0.115	0.0	0.0	0.00
126.0	15,030	0.345	5,008.7	5,008.7	0.11
127.0	22,016	0.505	18,522.9	23,531.7	0.54
128.0	26,410	0.606	24,212.9	47,744.6	1.10
129.0	30,895	0.709	28,652.5	76,397.1	1.75
130.0	35,117	0.806	33,006.0	109,403.1	2.51
131.0	39,436	0.905	37,276.5	146,679.6	3.37

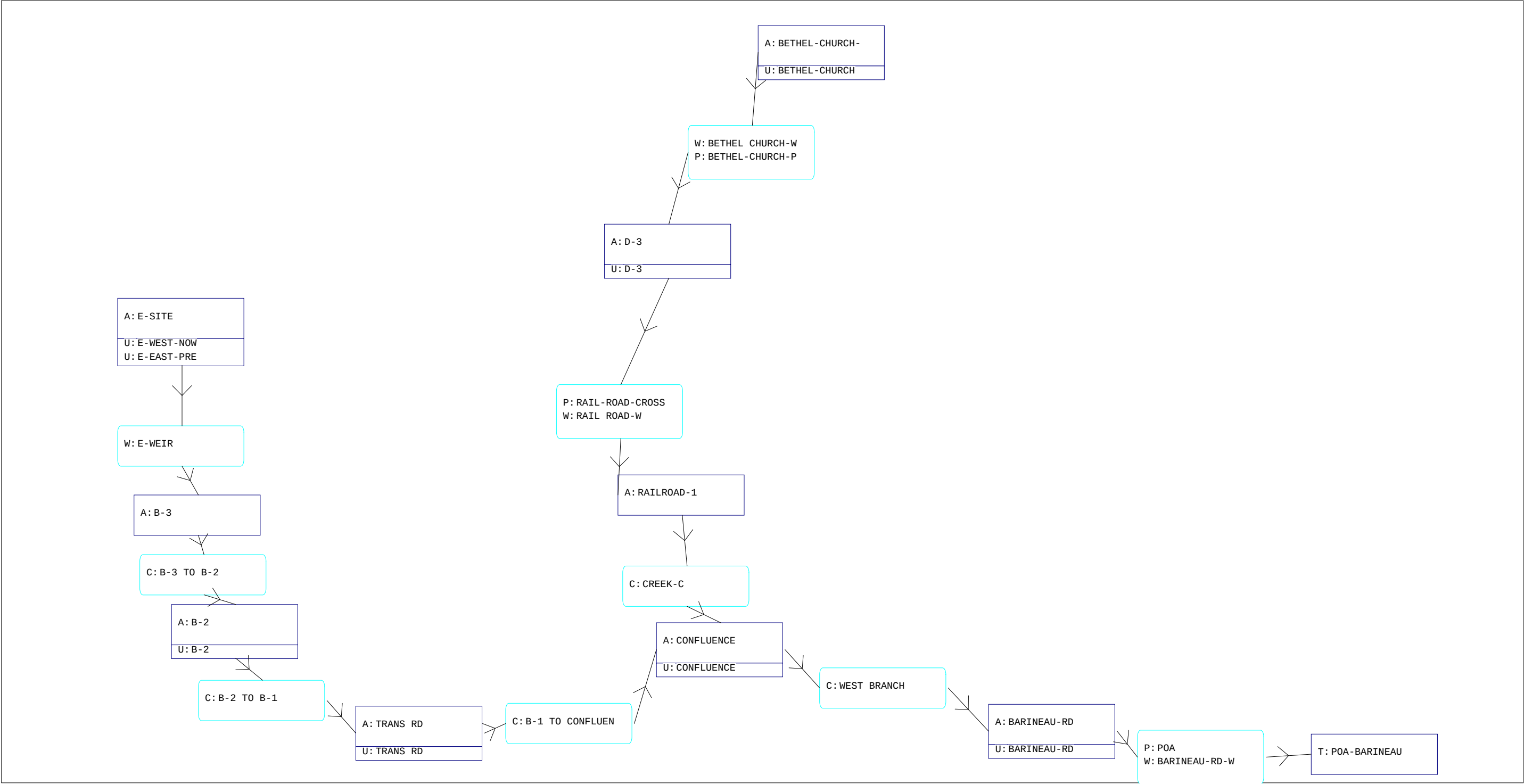


4. ICPR Stormwater Model

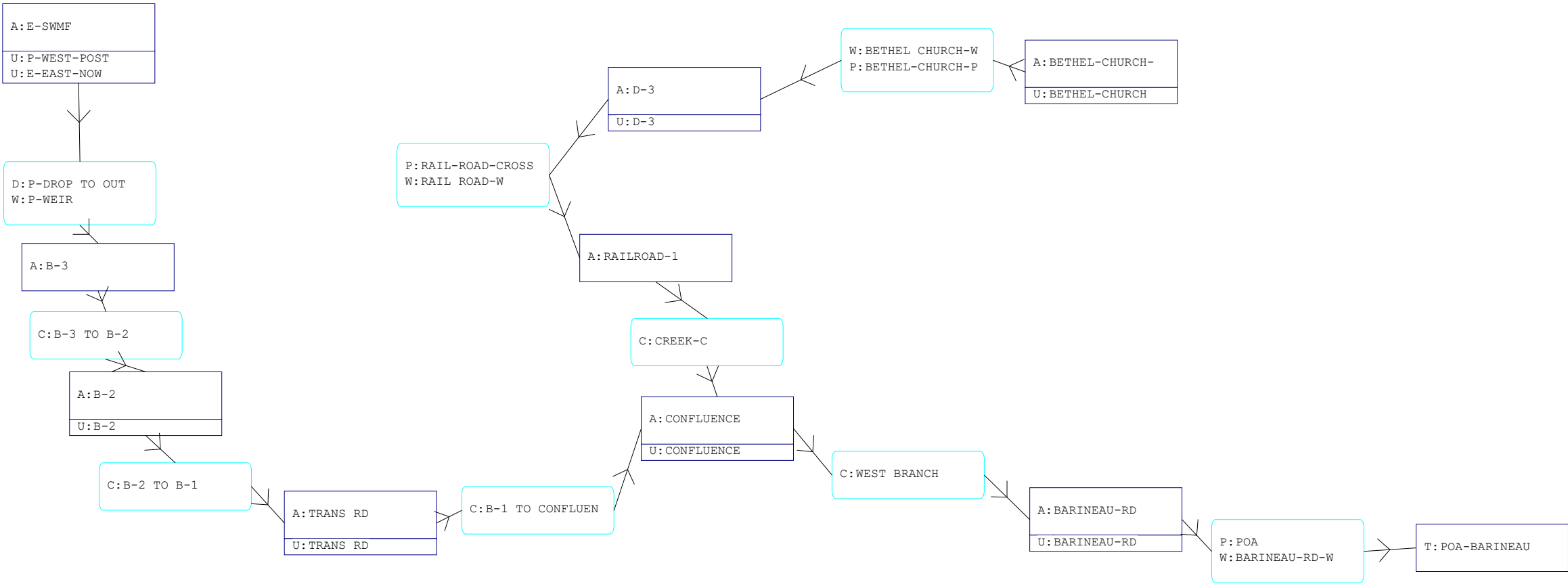
Nodes
A Stage/Area
V Stage/Volume
T Time/Stage
M Manhole

Basins
O Overland Flow
U SCS Unit CN
S SBUH CN
Y SCS Unit GA
Z SBUH GA

Links
P Pipe
W Weir
C Channel
D Drop Structure
B Bridge
R Rating Curve
H Breach
E Percolation
F Filter
X Exfil Trench



- Nodes
A Stage/Area
V Stage/Volume
T Time/Stage
M Manhole
- Basins
O Overland Flow
U SCS Unit CN
S SBUH CN
Y SCS Unit GA
Z SBUH GA
- Links
P Pipe
W Weir
C Channel
D Drop Structure
B Bridge
R Rating Curve
H Breach
E Percolation
F Filter
X Exfil Trench



West-Basin (Present) and East-Basin (Pre-Development) Input

==== Basins =====

Name: E-EAST-PRE	Node: E-EAST-PRE	Status: Onsite
Group: BASE	Type: SCS Unit Hydrograph CN	
Unit Hydrograph: Uh323	Peaking Factor: 323.0	
Rainfall File:	Storm Duration(hrs): 0.00	
Rainfall Amount(in): 0.000	Time of Conc(min): 28.20	
Area(ac): 2.140	Time Shift(hrs): 0.00	
Curve Number: 45.00	Max Allowable Q(cfs): 999999.000	
DCIA(%): 0.00		

Name: E-WEST-NOW	Node: E-WEST-NOW	Status: Onsite
Group: BASE	Type: SCS Unit Hydrograph CN	
Unit Hydrograph: Uh323	Peaking Factor: 323.0	
Rainfall File:	Storm Duration(hrs): 0.00	
Rainfall Amount(in): 0.000	Time of Conc(min): 5.00	
Area(ac): 4.920	Time Shift(hrs): 0.00	
Curve Number: 88.60	Max Allowable Q(cfs): 999999.000	
DCIA(%): 0.00		

==== Nodes =====

Name: E-EAST-PRE	Base Flow(cfs): 0.000	Init Stage(ft): 134.000
Group: BASE		Warn Stage(ft): 136.000
Type: Time/Stage		

Time(hrs)	Stage(ft)
0.00	134.000
99999.00	134.000

Name: E-WEST-NOW	Base Flow(cfs): 0.000	Init Stage(ft): 134.000
Group: BASE		Warn Stage(ft): 136.000
Type: Time/Stage		

Time(hrs)	Stage(ft)
0.00	134.000
99999.00	134.000

==== Cross Sections =====

Name:	Group: BASE
Encroachment: No	

Station(ft)	Elevation(ft)	Manning's N
-------------	---------------	-------------

==== Pipes =====

Name:	From Node:	Length(ft): 0.00
Group: BASE	To Node:	Count: 1
UPSTREAM	DOWNSTREAM	Friction Equation: Automatic
Geometry: Circular	Circular	Solution Algorithm: Most Restrictive
Span(in): 0.00	0.00	Flow: Both
Rise(in): 0.00	0.00	Entrance Loss Coef: 0.00
Invert(ft): 0.000	0.000	Exit Loss Coef: 1.00
Manning's N: 0.000000	0.000000	Bend Loss Coef: 0.00
Top Clip(in): 0.000	0.000	Outlet Ctrl Spec: Use dc or tw
		Inlet Ctrl Spec: Use dc

Bot Clip(in): 0.000 0.000 Stabilizer Option: None

Upstream FHWA Inlet Edge Description:
 Circular Concrete: Square edge w/ headwall

Downstream FHWA Inlet Edge Description:
 Circular Concrete: Square edge w/ headwall

==== Weirs =====

Name: From Node:
 Group: BASE To Node:
 Flow: Both Count: 1
 Type: Horizontal Geometry: Circular

Span(in): 0.00
 Rise(in): 0.00
 Invert(ft): 0.000
 Control Elevation(ft): 0.000

TABLE

Bottom Clip(in): 0.000
 Top Clip(in): 0.000
 Weir Discharge Coef: 3.200
 Orifice Discharge Coef: 0.600

==== Hydrology Simulations =====

Name: 100yr-1hr
 Filename: C:\Projects\100yr-1hr.R32

Override Defaults: Yes
 Storm Duration(hrs): 1.00
 Rainfall File: Fdot-1
 Rainfall Amount(in): 4.40

Time(hrs)	Print Inc(min)
2.000	2.00

Name: 100yr-24hr
 Filename: C:\Projects\100yr-24hr.R32

Override Defaults: Yes
 Storm Duration(hrs): 24.00
 Rainfall File: Fdot-24
 Rainfall Amount(in): 10.90

Time(hrs)	Print Inc(min)
24.000	2.00

Name: 100yr-2hr
 Filename: C:\Projects\100yr-2hr.R32

Override Defaults: Yes
 Storm Duration(hrs): 2.00
 Rainfall File: Fdot-2
 Rainfall Amount(in): 5.80

Time(hrs)	Print Inc(min)
2.000	2.00

Name: 100yr-4hr
 Filename: C:\Projects\100yr-4hr.R32

Override Defaults: Yes
 Storm Duration(hrs): 4.00
 Rainfall File: Fdot-4
 Rainfall Amount(in): 7.20

Time(hrs)	Print Inc(min)
4.000	2.00

Name: 100yr-8hr
 Filename: C:\Projects\100yr-8hr.R32
 Override Defaults: Yes
 Storm Duration(hrs): 8.00
 Rainfall File: Fdot-8
 Rainfall Amount(in): 8.90

Time(hrs)	Print Inc(min)
8.000	2.00

Name: 10yr-1hr
 Filename: C:\Projects\10yr-1hr.R32
 Override Defaults: Yes
 Storm Duration(hrs): 1.00
 Rainfall File: Fdot-1
 Rainfall Amount(in): 3.20

Time(hrs)	Print Inc(min)
2.000	2.00

Name: 10yr-24hr
 Filename: C:\Projects\10yr-24hr.R32
 Override Defaults: Yes
 Storm Duration(hrs): 24.00
 Rainfall File: Fdot-24
 Rainfall Amount(in): 7.50

Time(hrs)	Print Inc(min)
24.000	2.00

Name: 10yr-2hr
 Filename: C:\Projects\10yr-2hr.R32
 Override Defaults: Yes
 Storm Duration(hrs): 2.00
 Rainfall File: Fdot-2
 Rainfall Amount(in): 4.10

Time(hrs)	Print Inc(min)
2.000	2.00

Name: 10yr-4hr
 Filename: C:\Projects\10yr-4hr.R32
 Override Defaults: Yes
 Storm Duration(hrs): 4.00
 Rainfall File: Fdot-4
 Rainfall Amount(in): 5.00

Time(hrs)	Print Inc(min)
4.000	2.00

Name: 10yr-8hr
 Filename: C:\Projects\10yr-8hr.R32
 Override Defaults: Yes
 Storm Duration(hrs): 8.00
 Rainfall File: Fdot-8
 Rainfall Amount(in): 6.20

Time(hrs)	Print Inc(min)
8.000	2.00

Name: 25YR-1HR
Filename: C:\Projects\25YR-1HR.R32

Override Defaults: Yes
Storm Duration(hrs): 1.00
Rainfall File: Fdot-1
Rainfall Amount(in): 3.70

Time(hrs)	Print Inc(min)
2.000	2.00

Name: 25YR-24HR
Filename: C:\Projects\25YR-24HR.R32

Override Defaults: Yes
Storm Duration(hrs): 24.00
Rainfall File: Fdot-24
Rainfall Amount(in): 8.50

Time(hrs)	Print Inc(min)
24.000	2.00

Name: 25YR-2HR
Filename: C:\Projects\25YR-2HR.R32

Override Defaults: Yes
Storm Duration(hrs): 2.00
Rainfall File: Fdot-2
Rainfall Amount(in): 4.70

Time(hrs)	Print Inc(min)
2.000	2.00

Name: 25YR-4HR
Filename: C:\Projects\25YR-4HR.R32

Override Defaults: Yes
Storm Duration(hrs): 4.00
Rainfall File: Fdot-4
Rainfall Amount(in): 5.90

Time(hrs)	Print Inc(min)
4.000	2.00

Name: 25YR-8HR
Filename: C:\Projects\25YR-8HR.R32

Override Defaults: Yes
Storm Duration(hrs): 8.00
Rainfall File: Fdot-8
Rainfall Amount(in): 7.40

Time(hrs)	Print Inc(min)
8.000	2.00

Name: 2yr-1hr
Filename: C:\Projects\2yr-1hr.R32

Override Defaults: Yes
Storm Duration(hrs): 1.00
Rainfall File: Fdot-1
Rainfall Amount(in): 2.30

Time(hrs)	Print Inc(min)
2.000	2.00

Name: 2yr-24hr
Filename: C:\Projects\2yr-24hr.R32

Override Defaults: Yes

Storm Duration(hrs): 24.00
Rainfall File: Fdot-24
Rainfall Amount(in): 4.70

Time(hrs)	Print Inc(min)
24.000	2.00

Name: 2yr-2hr
Filename: C:\Projects\2yr-2hr.R32

Override Defaults: Yes
Storm Duration(hrs): 2.00
Rainfall File: Fdot-2
Rainfall Amount(in): 3.00

Time(hrs)	Print Inc(min)
2.000	2.00

Name: 2yr-4hr
Filename: C:\Projects\2yr-4hr.R32

Override Defaults: Yes
Storm Duration(hrs): 4.00
Rainfall File: Fdot-4
Rainfall Amount(in): 3.50

Time(hrs)	Print Inc(min)
4.000	2.00

Name: 2yr-8hr
Filename: C:\Projects\2yr-8hr.R32

Override Defaults: Yes
Storm Duration(hrs): 8.00
Rainfall File: Fdot-8
Rainfall Amount(in): 4.20

Time(hrs)	Print Inc(min)
8.000	2.00

Name: 50yr-1hr
Filename: C:\Projects\50yr-1hr.R32

Override Defaults: Yes
Storm Duration(hrs): 1.00
Rainfall File: Fdot-1
Rainfall Amount(in): 4.00

Time(hrs)	Print Inc(min)
2.000	2.00

Name: 50yr-24hr
Filename: C:\Projects\50yr-24hr.R32

Override Defaults: Yes
Storm Duration(hrs): 24.00
Rainfall File: Fdot-24
Rainfall Amount(in): 9.60

Time(hrs)	Print Inc(min)
24.000	2.00

Name: 50yr-2hr
Filename: C:\Projects\50yr-2hr.R32

Override Defaults: Yes
Storm Duration(hrs): 2.00
Rainfall File: Fdot-2
Rainfall Amount(in): 5.20

Time(hrs)	Print Inc(min)
-----------	----------------

2.000 2.00

Name: 50yr-4hr
Filename: C:\Projects\50yr-4hr.R32

Override Defaults: Yes
Storm Duration(hrs): 4.00
Rainfall File: Fdot-4
Rainfall Amount(in): 6.40

Time(hrs) Print Inc(min)

4.000 2.00

Name: 50yr-8hr
Filename: C:\Projects\50yr-8hr.R32

Override Defaults: Yes
Storm Duration(hrs): 8.00
Rainfall File: Fdot-8
Rainfall Amount(in): 8.00

Time(hrs) Print Inc(min)

8.000 2.00

Name: 5yr-1hr
Filename: C:\Projects\5yr-1hr.R32

Override Defaults: Yes
Storm Duration(hrs): 1.00
Rainfall File: Fdot-1
Rainfall Amount(in): 2.80

Time(hrs) Print Inc(min)

2.000 2.00

Name: 5yr-24hr
Filename: C:\Projects\5yr-24hr.R32

Override Defaults: Yes
Storm Duration(hrs): 24.00
Rainfall File: Fdot-24
Rainfall Amount(in): 6.40

Time(hrs) Print Inc(min)

24.000 2.00

Name: 5yr-2hr
Filename: C:\Projects\5yr-2hr.R32

Override Defaults: Yes
Storm Duration(hrs): 2.00
Rainfall File: Fdot-2
Rainfall Amount(in): 3.60

Time(hrs) Print Inc(min)

2.000 2.00

Name: 5yr-4hr
Filename: C:\Projects\5yr-4hr.R32

Override Defaults: Yes
Storm Duration(hrs): 4.00
Rainfall File: Fdot-4
Rainfall Amount(in): 4.40

Time(hrs) Print Inc(min)

4.000 2.00

Name: 5yr-8hr

Filename: C:\Projects\5yr-8hr.R32

Override Defaults: Yes
Storm Duration(hrs): 8.00
Rainfall File: Fdot-8
Rainfall Amount(in): 5.50

Time(hrs)	Print Inc(min)
8.000	2.00

==== Routing Simulations =====

Name: 100yr-1hr Hydrology Sim: 100yr-1hr
Filename: C:\Projects\100yr-1hr.I32

Execute: Yes Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00	Delta Z Factor: 0.00500
Time Step Optimizer: 10.000	
Start Time(hrs): 0.000	End Time(hrs): 2.00
Min Calc Time(sec): 0.5000	Max Calc Time(sec): 60.0000
Boundary Stages:	Boundary Flows:

Time(hrs)	Print Inc(min)
2.000	2.000

Group	Run
BASE	Yes

Name: 100yr-24hr Hydrology Sim: 100yr-24hr
Filename: C:\Projects\100yr-24hr.I32

Execute: Yes Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00	Delta Z Factor: 0.00500
Time Step Optimizer: 10.000	
Start Time(hrs): 0.000	End Time(hrs): 24.00
Min Calc Time(sec): 0.5000	Max Calc Time(sec): 60.0000
Boundary Stages:	Boundary Flows:

Time(hrs)	Print Inc(min)
24.000	2.000

Group	Run
BASE	Yes

Name: 100yr-2hr Hydrology Sim: 100yr-2hr
Filename: C:\Projects\100yr-2hr.I32

Execute: Yes Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00	Delta Z Factor: 0.00500
Time Step Optimizer: 10.000	
Start Time(hrs): 0.000	End Time(hrs): 2.00
Min Calc Time(sec): 0.5000	Max Calc Time(sec): 60.0000
Boundary Stages:	Boundary Flows:

Time(hrs)	Print Inc(min)
2.000	2.000

Group	Run

BASE Yes

Name: 100yr-4hr Hydrology Sim: 100yr-4hr
 Filename: C:\Projects\100yr-4hr.I32

Execute: Yes Restart: No Patch: No
 Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
 Time Step Optimizer: 10.000
 Start Time(hrs): 0.000 End Time(hrs): 4.00
 Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
 Boundary Stages: Boundary Flows:

Time(hrs) Print Inc(min)

 4.000 2.000

Group Run

 BASE Yes

Name: 100yr-8hr Hydrology Sim: 100yr-8hr
 Filename: C:\Projects\100yr-8hr.I32

Execute: Yes Restart: No Patch: No
 Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
 Time Step Optimizer: 10.000
 Start Time(hrs): 0.000 End Time(hrs): 8.00
 Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
 Boundary Stages: Boundary Flows:

Time(hrs) Print Inc(min)

 8.000 2.000

Group Run

 BASE Yes

Name: 10yr-1hr Hydrology Sim: 10YR-1HR
 Filename: C:\Projects\10yr-1hr.I32

Execute: Yes Restart: No Patch: No
 Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
 Time Step Optimizer: 10.000
 Start Time(hrs): 0.000 End Time(hrs): 2.00
 Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
 Boundary Stages: Boundary Flows:

Time(hrs) Print Inc(min)

 2.000 2.000

Group Run

 BASE Yes

Name: 10yr-24hr Hydrology Sim: 10YR-24HR
 Filename: C:\Projects\10yr-24hr.I32

Execute: Yes Restart: No Patch: No
 Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500

Time Step Optimizer: 10.000	End Time(hrs): 24.00
Start Time(hrs): 0.000	Max Calc Time(sec): 60.0000
Min Calc Time(sec): 0.5000	Boundary Flows:
Boundary Stages:	

Time(hrs)	Print Inc(min)
-----	-----
24.000	2.000
Group	Run
-----	-----
BASE	Yes

Name: 10yr-2hr	Hydrology Sim: 10YR-2HR
Filename: C:\Projects\10yr-2hr.I32	

Execute: Yes	Restart: No	Patch: No
Alternative: No		

Max Delta Z(ft): 1.00	Delta Z Factor: 0.00500
Time Step Optimizer: 10.000	
Start Time(hrs): 0.000	End Time(hrs): 2.00
Min Calc Time(sec): 0.5000	Max Calc Time(sec): 60.0000
Boundary Stages:	Boundary Flows:

Time(hrs)	Print Inc(min)
-----	-----
2.000	2.000
Group	Run
-----	-----
BASE	Yes

Name: 10yr-4hr	Hydrology Sim: 10YR-4HR
Filename: C:\Projects\10yr-4hr.I32	

Execute: Yes	Restart: No	Patch: No
Alternative: No		

Max Delta Z(ft): 1.00	Delta Z Factor: 0.00500
Time Step Optimizer: 10.000	
Start Time(hrs): 0.000	End Time(hrs): 4.00
Min Calc Time(sec): 0.5000	Max Calc Time(sec): 60.0000
Boundary Stages:	Boundary Flows:

Time(hrs)	Print Inc(min)
-----	-----
4.000	2.000
Group	Run
-----	-----
BASE	Yes

Name: 10yr-8hr	Hydrology Sim: 10YR-8HR
Filename: C:\Projects\10yr-8hr.I32	

Execute: Yes	Restart: No	Patch: No
Alternative: No		

Max Delta Z(ft): 1.00	Delta Z Factor: 0.00500
Time Step Optimizer: 10.000	
Start Time(hrs): 0.000	End Time(hrs): 8.00
Min Calc Time(sec): 0.5000	Max Calc Time(sec): 60.0000
Boundary Stages:	Boundary Flows:

Time(hrs)	Print Inc(min)
-----	-----
8.000	2.000

Group	Run
-----	-----
BASE	Yes

Name: 25yr-1hr	Hydrology Sim: 25YR-1HR
Filename: C:\Projects\25yr-1hr.I32	
Execute: Yes	Restart: No
Alternative: No	Patch: No
Max Delta Z(ft): 1.00	Delta Z Factor: 0.00500
Time Step Optimizer: 10.000	
Start Time(hrs): 0.000	End Time(hrs): 2.00
Min Calc Time(sec): 0.5000	Max Calc Time(sec): 60.0000
Boundary Stages:	Boundary Flows:

Time(hrs)	Print Inc(min)
-----	-----
2.000	2.000

Group	Run
-----	-----
BASE	Yes

Name: 25yr-24hr	Hydrology Sim: 25YR-24HR
Filename: C:\Projects\25yr-24hr.I32	
Execute: Yes	Restart: No
Alternative: No	Patch: No
Max Delta Z(ft): 1.00	Delta Z Factor: 0.00500
Time Step Optimizer: 10.000	
Start Time(hrs): 0.000	End Time(hrs): 24.00
Min Calc Time(sec): 0.5000	Max Calc Time(sec): 60.0000
Boundary Stages:	Boundary Flows:

Time(hrs)	Print Inc(min)
-----	-----
24.000	2.000

Group	Run
-----	-----
BASE	Yes

Name: 25yr-2hr	Hydrology Sim: 25YR-2HR
Filename: C:\Projects\25yr-2hr.I32	
Execute: Yes	Restart: No
Alternative: No	Patch: No
Max Delta Z(ft): 1.00	Delta Z Factor: 0.00500
Time Step Optimizer: 10.000	
Start Time(hrs): 0.000	End Time(hrs): 2.00
Min Calc Time(sec): 0.5000	Max Calc Time(sec): 60.0000
Boundary Stages:	Boundary Flows:

Time(hrs)	Print Inc(min)
-----	-----
2.000	2.000

Group	Run
-----	-----
BASE	Yes

Name: 25yr-4hr	Hydrology Sim: 25YR-4HR
Filename: C:\Projects\25yr-4hr.I32	
Execute: Yes	Restart: No
Alternative: No	Patch: No

Max Delta Z(ft): 1.00	Delta Z Factor: 0.00500
Time Step Optimizer: 10.000	
Start Time(hrs): 0.000	End Time(hrs): 4.00
Min Calc Time(sec): 0.5000	Max Calc Time(sec): 60.0000
Boundary Stages:	Boundary Flows:

Time(hrs)	Print Inc(min)
-----	-----
4.000	2.000

Group	Run
-----	-----
BASE	Yes

Name: 25yr-8hr	Hydrology Sim: 25YR-8HR
Filename: C:\Projects\25yr-8hr.I32	

Execute: Yes	Restart: No	Patch: No
Alternative: No		

Max Delta Z(ft): 1.00	Delta Z Factor: 0.00500
Time Step Optimizer: 10.000	
Start Time(hrs): 0.000	End Time(hrs): 8.00
Min Calc Time(sec): 0.5000	Max Calc Time(sec): 60.0000
Boundary Stages:	Boundary Flows:

Time(hrs)	Print Inc(min)
-----	-----
8.000	2.000

Group	Run
-----	-----
BASE	Yes

Name: 2yr-1hr	Hydrology Sim: 2YR-1HR
Filename: C:\Projects\2yr-1hr.I32	

Execute: Yes	Restart: No	Patch: No
Alternative: No		

Max Delta Z(ft): 1.00	Delta Z Factor: 0.00500
Time Step Optimizer: 10.000	
Start Time(hrs): 0.000	End Time(hrs): 2.00
Min Calc Time(sec): 0.5000	Max Calc Time(sec): 60.0000
Boundary Stages:	Boundary Flows:

Time(hrs)	Print Inc(min)
-----	-----
2.000	2.000

Group	Run
-----	-----
BASE	Yes

Name: 2yr-24hr	Hydrology Sim: 2YR-24HR
Filename: C:\Projects\2yr-24hr.I32	

Execute: Yes	Restart: No	Patch: No
Alternative: No		

Max Delta Z(ft): 1.00	Delta Z Factor: 0.00500
Time Step Optimizer: 10.000	
Start Time(hrs): 0.000	End Time(hrs): 24.00
Min Calc Time(sec): 0.5000	Max Calc Time(sec): 60.0000
Boundary Stages:	Boundary Flows:

Time(hrs)	Print Inc(min)
-----	-----

24.000 2.000

 Group Run

 BASE Yes

 Name: 2yr-2hr Hydrology Sim: 2YR-2HR
 Filename: C:\Projects\2yr-2hr.I32

Execute: Yes Restart: No Patch: No
 Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
 Time Step Optimizer: 10.000
 Start Time(hrs): 0.000 End Time(hrs): 2.00
 Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
 Boundary Stages: Boundary Flows:

Time(hrs) Print Inc(min)

 2.000 2.000

 Group Run

 BASE Yes

 Name: 2yr-4hr Hydrology Sim: 2YR-4HR
 Filename: C:\Projects\2yr-4hr.I32

Execute: Yes Restart: No Patch: No
 Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
 Time Step Optimizer: 10.000
 Start Time(hrs): 0.000 End Time(hrs): 4.00
 Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
 Boundary Stages: Boundary Flows:

Time(hrs) Print Inc(min)

 4.000 2.000

 Group Run

 BASE Yes

 Name: 2yr-8hr Hydrology Sim: 2YR-8HR
 Filename: C:\Projects\2yr-8hr.I32

Execute: Yes Restart: No Patch: No
 Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
 Time Step Optimizer: 10.000
 Start Time(hrs): 0.000 End Time(hrs): 8.00
 Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
 Boundary Stages: Boundary Flows:

Time(hrs) Print Inc(min)

 8.000 2.000

 Group Run

 BASE Yes

 Name: 50yr-1hr Hydrology Sim: 50YR-1HR
 Filename: C:\Projects\50yr-1hr.I32

Execute: Yes	Restart: No	Patch: No
Alternative: No		
Max Delta Z(ft): 1.00		Delta Z Factor: 0.00500
Time Step Optimizer: 10.000		
Start Time(hrs): 0.000		End Time(hrs): 2.00
Min Calc Time(sec): 0.5000	Max	Calc Time(sec): 60.0000
Boundary Stages:		Boundary Flows:

Time(hrs)	Print Inc(min)
-----	-----
2.000	2.000
Group	Run
-----	-----
BASE	Yes

Name: 50yr-24hr Hydrology Sim: 50YR-24HR
 Filename: C:\Projects\50yr-24hr.I32

Execute: Yes	Restart: No	Patch: No
Alternative: No		
Max Delta Z(ft): 1.00		Delta Z Factor: 0.00500
Time Step Optimizer: 10.000		
Start Time(hrs): 0.000		End Time(hrs): 24.00
Min Calc Time(sec): 0.5000	Max	Calc Time(sec): 60.0000
Boundary Stages:		Boundary Flows:

Time(hrs)	Print Inc(min)
-----	-----
24.000	2.000
Group	Run
-----	-----
BASE	Yes

Name: 50yr-2hr Hydrology Sim: 50YR-2HR
 Filename: C:\Projects\50yr-2hr.I32

Execute: Yes	Restart: No	Patch: No
Alternative: No		
Max Delta Z(ft): 1.00		Delta Z Factor: 0.00500
Time Step Optimizer: 10.000		
Start Time(hrs): 0.000		End Time(hrs): 2.00
Min Calc Time(sec): 0.5000	Max	Calc Time(sec): 60.0000
Boundary Stages:		Boundary Flows:

Time(hrs)	Print Inc(min)
-----	-----
2.000	2.000
Group	Run
-----	-----
BASE	Yes

Name: 50yr-4hr Hydrology Sim: 50YR-4HR
 Filename: C:\Projects\50yr-4hr.I32

Execute: Yes	Restart: No	Patch: No
Alternative: No		
Max Delta Z(ft): 1.00		Delta Z Factor: 0.00500
Time Step Optimizer: 10.000		
Start Time(hrs): 0.000		End Time(hrs): 4.00
Min Calc Time(sec): 0.5000	Max	Calc Time(sec): 60.0000
Boundary Stages:		Boundary Flows:

Time(hrs)	Print Inc(min)
-----	-----
4.000	2.000
Group	Run
-----	-----
BASE	Yes

 Name: 50yr-8hr Hydrology Sim: 50YR-8HR
 Filename: C:\Projects\50yr-8hr.I32

Execute: Yes Restart: No Patch: No
 Alternative: No

Max Delta Z(ft): 1.00	Delta Z Factor: 0.00500
Time Step Optimizer: 10.000	
Start Time(hrs): 0.000	End Time(hrs): 8.00
Min Calc Time(sec): 0.5000	Max Calc Time(sec): 60.0000
Boundary Stages:	Boundary Flows:

Time(hrs)	Print Inc(min)
-----	-----
8.000	2.000
Group	Run
-----	-----
BASE	Yes

 Name: 5yr-1hr Hydrology Sim: 5YR-1HR
 Filename: C:\Projects\5yr-1hr.I32

Execute: Yes Restart: No Patch: No
 Alternative: No

Max Delta Z(ft): 1.00	Delta Z Factor: 0.00500
Time Step Optimizer: 10.000	
Start Time(hrs): 0.000	End Time(hrs): 2.00
Min Calc Time(sec): 0.5000	Max Calc Time(sec): 60.0000
Boundary Stages:	Boundary Flows:

Time(hrs)	Print Inc(min)
-----	-----
2.000	2.000
Group	Run
-----	-----
BASE	Yes

 Name: 5yr-24hr Hydrology Sim: 5YR-24HR
 Filename: C:\Projects\5yr-24hr.I32

Execute: Yes Restart: No Patch: No
 Alternative: No

Max Delta Z(ft): 1.00	Delta Z Factor: 0.00500
Time Step Optimizer: 10.000	
Start Time(hrs): 0.000	End Time(hrs): 24.00
Min Calc Time(sec): 0.5000	Max Calc Time(sec): 60.0000
Boundary Stages:	Boundary Flows:

Time(hrs)	Print Inc(min)
-----	-----
24.000	2.000
Group	Run
-----	-----
BASE	Yes

 Name: 5yr-2hr Hydrology Sim: 5YR-2HR

Filename: C:\Projects\5yr-2hr.I32

Execute: Yes Restart: No Patch: No
 Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
 Time Step Optimizer: 10.000
 Start Time(hrs): 0.000 End Time(hrs): 2.00
 Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
 Boundary Stages: Boundary Flows:

Time(hrs) Print Inc(min)

 2.000 2.000

Group Run

 BASE Yes

Name: 5yr-4hr Hydrology Sim: 5YR-4HR
 Filename: C:\Projects\5yr-4hr.I32

Execute: Yes Restart: No Patch: No
 Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
 Time Step Optimizer: 10.000
 Start Time(hrs): 0.000 End Time(hrs): 4.00
 Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
 Boundary Stages: Boundary Flows:

Time(hrs) Print Inc(min)

 4.000 2.000

Group Run

 BASE Yes

Name: 5yr-8hr Hydrology Sim: 5YR-8HR
 Filename: C:\Projects\5yr-8hr.I32

Execute: Yes Restart: No Patch: No
 Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
 Time Step Optimizer: 10.000
 Start Time(hrs): 0.000 End Time(hrs): 8.00
 Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
 Boundary Stages: Boundary Flows:

Time(hrs) Print Inc(min)

 8.000 2.000

Group Run

 BASE Yes

=====
 Boundary Conditions =====

Name: Node: E-South Type: Stage

Time(hrs) Stage(ft)

 0.000 85.000
 900.000 85.000

Downstream Analysis Pre-Development Input

==== Basins =====

Name: B-2 Node: B-2 Status: Onsite
Group: DOWN-STREAM-ANA Type: SCS Unit Hydrograph CN

Unit Hydrograph: Uh323 Peaking Factor: 323.0
Rainfall File: Storm Duration(hrs): 0.00
Rainfall Amount(in): 0.000 Time of Conc(min): 42.00
Area(ac): 83.660 Time Shift(hrs): 0.00
Curve Number: 32.70 Max Allowable Q(cfs): 999999.000
DCIA(%): 0.00

Name: BARINEAU-RD Node: BARINEAU-RD Status: Onsite
Group: DOWN-STREAM-ANA Type: SCS Unit Hydrograph CN

Unit Hydrograph: Uh323 Peaking Factor: 323.0
Rainfall File: Storm Duration(hrs): 0.00
Rainfall Amount(in): 0.000 Time of Conc(min): 30.00
Area(ac): 38.940 Time Shift(hrs): 0.00
Curve Number: 37.10 Max Allowable Q(cfs): 999999.000
DCIA(%): 0.00

Name: BETHEL-CHURCH Node: BETHEL-CHURCH- Status: Onsite
Group: DOWN-STREAM-ANA Type: SCS Unit Hydrograph CN

Unit Hydrograph: Uh323 Peaking Factor: 323.0
Rainfall File: Storm Duration(hrs): 0.00
Rainfall Amount(in): 0.000 Time of Conc(min): 10.00
Area(ac): 31.480 Time Shift(hrs): 0.00
Curve Number: 37.10 Max Allowable Q(cfs): 999999.000
DCIA(%): 0.00

Name: CONFLUENCE Node: CONFLUENCE Status: Onsite
Group: DOWN-STREAM-ANA Type: SCS Unit Hydrograph CN

Unit Hydrograph: Uh323 Peaking Factor: 323.0
Rainfall File: Storm Duration(hrs): 0.00
Rainfall Amount(in): 0.000 Time of Conc(min): 33.00
Area(ac): 23.280 Time Shift(hrs): 0.00
Curve Number: 31.00 Max Allowable Q(cfs): 999999.000
DCIA(%): 0.00

Name: D-3 Node: D-3 Status: Onsite
Group: DOWN-STREAM-ANA Type: SCS Unit Hydrograph CN

Unit Hydrograph: Uh323 Peaking Factor: 323.0
Rainfall File: Storm Duration(hrs): 0.00
Rainfall Amount(in): 0.000 Time of Conc(min): 32.00
Area(ac): 92.770 Time Shift(hrs): 0.00
Curve Number: 47.90 Max Allowable Q(cfs): 999999.000
DCIA(%): 0.00

Name: E-EAST-PRE Node: E-SITE Status: Onsite
Group: DOWN-STREAM-ANA Type: SCS Unit Hydrograph CN

Unit Hydrograph: Uh323 Peaking Factor: 323.0
Rainfall File: Storm Duration(hrs): 0.00
Rainfall Amount(in): 0.000 Time of Conc(min): 28.20
Area(ac): 2.140 Time Shift(hrs): 0.00
Curve Number: 45.00 Max Allowable Q(cfs): 999999.000
DCIA(%): 0.00

East Basin in Pre-development conditions;
Use CN and Tc values from Record Storm Report

```

-----
Name: E-WEST-NOW      Node: E-SITE      Status: Onsite
Group: DOWN-STREAM-ANA Type: SCS Unit Hydrograph CN

Unit Hydrograph: Uh323      Peaking Factor: 323.0
Rainfall File:      Storm Duration(hrs): 0.00
Rainfall Amount(in): 0.000  Time of Conc(min): 5.00
Area(ac): 4.920      Time Shift(hrs): 0.00
Curve Number: 88.60   Max Allowable Q(cfs): 999999.000
DCIA(%): 0.00
  
```

West Basin in present conditions

```

-----
Name: TRANS RD      Node: TRANS RD      Status: Onsite
Group: DOWN-STREAM-ANA Type: SCS Unit Hydrograph CN

Unit Hydrograph: Uh323      Peaking Factor: 323.0
Rainfall File:      Storm Duration(hrs): 0.00
Rainfall Amount(in): 0.000  Time of Conc(min): 44.00
Area(ac): 67.110      Time Shift(hrs): 0.00
Curve Number: 33.80   Max Allowable Q(cfs): 999999.000
DCIA(%): 0.00
  
```

==== Nodes =====

```

Name: B-2      Base Flow(cfs): 0.000      Init Stage(ft): 120.000
Group: DOWN-STREAM-ANA      Warn Stage(ft): 123.000
Type: Stage/Area
  
```

Assumed node to have some storage, from depression near converge of contours
 Estimate storage amount

Stage(ft)	Area(ac)
120.000	0.2000
122.000	1.0000

```

-----
Name: B-3      Base Flow(cfs): 0.000      Init Stage(ft): 124.000
Group: DOWN-STREAM-ANA      Warn Stage(ft): 126.000
Type: Stage/Area
  
```

Stage(ft)	Area(ac)
124.000	0.0001
129.800	0.0002

```

-----
Name: BARINEAU-RD      Base Flow(cfs): 0.000      Init Stage(ft): 93.640
Group: DOWN-STREAM-ANA      Warn Stage(ft): 102.000
Type: Stage/Area
  
```

Assumed Barineau Rd node to have some minor storage, from depression
 Estimate small storage amount
 FEMA Base Flood Elevation (BFE) = 102

Stage(ft)	Area(ac)
93.640	0.0100
94.000	0.0150
95.000	0.2500
96.000	0.5000

```

-----
Name: BETHEL-CHURCH-      Base Flow(cfs): 0.000      Init Stage(ft): 142.000
Group: DOWN-STREAM-ANA      Warn Stage(ft): 155.000
Type: Stage/Area
  
```

EXISTING POND AT BETHEL CHURCH RD

Stage(ft)	Area(ac)
142.000	3.2170
144.000	3.6500
146.000	4.2230
148.000	4.9510

150.000	5.7120
152.000	6.4080
154.000	7.3200

Name: CONFLUENCE	Base Flow(cfs): 0.000	Init Stage(ft): 104.000
Group: DOWN-STREAM-ANA		Warn Stage(ft): 107.500
Type: Stage/Area		

Assumed Confluence to have some minor storage
 Estimate small storage amount

Stage(ft)	Area(ac)
104.000	0.0010
105.000	0.0020
106.000	0.0030
107.000	0.0050
108.000	0.2000
110.000	0.6000

Name: D-3	Base Flow(cfs): 0.000	Init Stage(ft): 115.000
Group: DOWN-STREAM-ANA		Warn Stage(ft): 126.000
Type: Stage/Area		

Floodplain Depressions Combined together

Stage(ft)	Area(ac)
115.000	0.5050
117.000	1.3070
119.000	3.1890

Name: E-SITE	Base Flow(cfs): 0.000	Init Stage(ft): 125.500
Group: DOWN-STREAM-ANA		Warn Stage(ft): 131.000
Type: Stage/Area		

Existing Site from both basins

Stage(ft)	Area(ac)
125.500	0.0001
129.800	0.0002

Name: POA-BARINEAU	Base Flow(cfs): 0.000	Init Stage(ft): 92.000
Group: DOWN-STREAM-ANA		Warn Stage(ft): 95.000
Type: Time/Stage		

Time(hrs)	Stage(ft)
0.00	92.000
99999.00	92.000

Name: RAILROAD-1	Base Flow(cfs): 0.000	Init Stage(ft): 115.000
Group: DOWN-STREAM-ANA		Warn Stage(ft): 125.000
Type: Stage/Area		

Stage(ft)	Area(ac)
115.000	0.0000
129.800	0.0001

Name: TRANS RD	Base Flow(cfs): 0.000	Init Stage(ft): 110.000
Group: DOWN-STREAM-ANA		Warn Stage(ft): 112.000
Type: Stage/Area		

Assumed node to have some storage, from depression near dirt road crossing
 Estimate storage amount

Stage(ft)	Area(ac)
110.000	0.0900
112.000	0.3300

==== Cross Sections =====

Name: A-1 Group: DOWN-STREAM-ANA
 Encroachment: No

Winding channel paths and ineffective slopes

Station(ft)	Elevation(ft)	Manning's N
-91.190	102.000	0.045000
-68.370	100.000	0.045000
-37.150	98.000	0.045000
-8.670	96.000	0.045000
0.000	94.000	0.045000
5.400	96.000	0.045000
41.370	98.000	0.045000
71.720	100.000	0.045000

Name: A-2 Group: DOWN-STREAM-ANA
 Encroachment: No

Station(ft)	Elevation(ft)	Manning's N
-131.080	110.000	0.035000
-105.180	108.000	0.035000
-70.620	106.000	0.035000
0.000	104.000	0.035000
57.950	106.000	0.035000
81.130	108.000	0.035000
111.500	110.000	0.035000

Name: B-0 Group: DOWN-STREAM-ANA
 Encroachment: No

Station(ft)	Elevation(ft)	Manning's N
-58.430	108.000	0.035000
0.000	106.000	0.035000
77.220	108.000	0.035000

Name: B-1 Group: DOWN-STREAM-ANA
 Encroachment: No

Station(ft)	Elevation(ft)	Manning's N
-171.540	112.000	0.035000
-23.320	110.000	0.035000
18.470	110.000	0.035000
126.390	112.000	0.035000

Name: B-2 Group: DOWN-STREAM-ANA
 Encroachment: No

Station(ft)	Elevation(ft)	Manning's N
-18.010	126.000	0.035000
-13.770	124.000	0.035000
-10.120	122.000	0.035000
-4.890	120.000	0.035000
5.480	120.000	0.035000
10.460	122.000	0.035000
15.480	124.000	0.035000
22.400	126.000	0.035000

Name: B-3 Group: DOWN-STREAM-ANA
 Encroachment: No

Station(ft)	Elevation(ft)	Manning's N
-234.890	128.000	0.035000
-186.500	126.000	0.035000
-111.730	124.000	0.035000
46.820	124.000	0.035000
113.870	124.000	0.035000
134.220	124.000	0.035000
177.520	126.000	0.035000
238.820	128.000	0.035000

 Name: BETHEL-CHURCH-R Group: DOWN-STREAM-ANA
 Encroachment: No

BETHEL CHURCH RD AS WEIR

Station(ft)	Elevation(ft)	Manning's N
-84.000	152.330	0.012000
-50.540	151.990	0.012000
0.000	151.310	0.012000
30.570	151.140	0.012000
72.470	150.940	0.012000

 Name: C-1 Group: DOWN-STREAM-ANA
 Encroachment: No

Station(ft)	Elevation(ft)	Manning's N
-149.430	114.000	0.035000
-59.040	112.000	0.035000
0.000	110.000	0.035000
64.880	112.000	0.035000
117.190	114.000	0.035000

 Name: C-2 Group: DOWN-STREAM-ANA
 Encroachment: No

Station(ft)	Elevation(ft)	Manning's N
-182.370	120.000	0.035000
-142.530	118.000	0.035000
-61.050	116.000	0.035000
0.000	115.000	0.035000
69.860	116.000	0.035000
114.690	118.000	0.035000
139.950	120.000	0.035000

 Name: D-1 Group: DOWN-STREAM-ANA
 Encroachment: No

Station(ft)	Elevation(ft)	Manning's N
-96.450	120.000	0.035000
-61.000	120.000	0.035000
0.000	118.000	0.035000
56.200	120.000	0.035000
96.490	122.000	0.035000

 Name: D-2 Group: DOWN-STREAM-ANA
 Encroachment: No

Station(ft)	Elevation(ft)	Manning's N
-101.030	124.000	0.035000
70.410	122.000	0.035000
76.980	122.000	0.035000
151.890	124.000	0.035000

==== Pipes =====

Name: BETHEL-CHURCH-P	From Node: BETHEL-CHURCH-	Length(ft): 40.26
Group: DOWN-STREAM-ANA	To Node: D-3	Count: 1
	Friction Equation: Automatic	
	Solution Algorithm: Most Restrictive	
	Flow: Both	
UPSTREAM	DOWNSIDE	
Geometry: Circular	Circular	
Span(in): 24.00	24.00	Entrance Loss Coef: 0.00
Rise(in): 24.00	24.00	Exit Loss Coef: 1.00
Invert(ft): 148.500	148.200	Bend Loss Coef: 0.00
Manning's N: 0.120000	0.120000	Outlet Ctrl Spec: Use dc or tw
Top Clip(in): 0.000	0.000	Inlet Ctrl Spec: Use dc
Bot Clip(in): 0.000	0.000	Stabilizer Option: None

Upstream FHWA Inlet Edge Description:
 Circular CMP: Headwall

Downstream FHWA Inlet Edge Description:
 Circular CMP: Headwall

Name: POA	From Node: BARINEAU-RD	Length(ft): 28.08
Group: DOWN-STREAM-ANA	To Node: POA-BARINEAU	Count: 1
	Friction Equation: Automatic	
	Solution Algorithm: Most Restrictive	
	Flow: Both	
UPSTREAM	DOWNSIDE	
Geometry: Rectangular	Rectangular	
Span(in): 92.40	92.40	Entrance Loss Coef: 0.00
Rise(in): 48.00	48.00	Exit Loss Coef: 1.00
Invert(ft): 93.640	93.360	Bend Loss Coef: 0.00
Manning's N: 0.120000	0.120000	Outlet Ctrl Spec: Use dc or tw
Top Clip(in): 0.000	0.000	Inlet Ctrl Spec: Use dc
Bot Clip(in): 0.000	0.000	Stabilizer Option: None

Upstream FHWA Inlet Edge Description:
 Rectangular Box: 3/4" chamfers; 30° skewed headwall

Downstream FHWA Inlet Edge Description:
 Rectangular Box: 0° wingwall flares

Name: RAIL-ROAD-CROSS	From Node: D-3	Length(ft): 49.00
Group: DOWN-STREAM-ANA	To Node: RAILROAD-1	Count: 1
	Friction Equation: Automatic	
	Solution Algorithm: Automatic	
	Flow: Positive	
UPSTREAM	DOWNSIDE	
Geometry: Circular	Circular	
Span(in): 42.00	42.00	Entrance Loss Coef: 0.00
Rise(in): 42.00	42.00	Exit Loss Coef: 1.00
Invert(ft): 115.880	115.800	Bend Loss Coef: 0.00
Manning's N: 0.120000	0.120000	Outlet Ctrl Spec: Use dc or tw
Top Clip(in): 0.000	0.000	Inlet Ctrl Spec: Use dc
Bot Clip(in): 0.000	0.000	Stabilizer Option: None

Upstream FHWA Inlet Edge Description:
 Circular Concrete: Square edge w/ headwall

Downstream FHWA Inlet Edge Description:
 Circular Concrete: Groove end projecting

==== Channels =====

Name: B-1 TO CONFLUEN	From Node: TRANS RD	Length(ft): 269.67
Group: DOWN-STREAM-ANA	To Node: CONFLUENCE	Count: 1
	Friction Equation: Automatic	
	Solution Algorithm: Automatic	
	Flow: Positive	
UPSTREAM	DOWNSIDE	
Geometry: Irregular	Irregular	
Invert(ft): 110.000	106.000	
TClpInitZ(ft): 9999.000	9999.000	Contraction Coef: 0.100

Manning's N:		Expansion Coef: 0.300
Top Clip(ft):		Entrance Loss Coef: 0.000
Bot Clip(ft):		Exit Loss Coef: 0.000
Main XSec: B-1	B-0	Outlet Ctrl Spec: Use dc or tw
AuxElev1(ft): 0.000	0.000	Inlet Ctrl Spec: Use dc
Aux XSec1:		Stabilizer Option: None
AuxElev2(ft): 0.000	0.000	
Aux XSec2:		
Top Width(ft):		
Depth(ft):		
Bot Width(ft):		
LtSdSlp(h/v):		
RtSdSlp(h/v):		

Name: B-2 TO B-1	From Node: B-2	Length(ft): 1170.00
Group: DOWN-STREAM-ANA	To Node: TRANS RD	Count: 1

UPSTREAM	DOWNSTREAM	Friction Equation: Automatic
Geometry: Irregular	Irregular	Solution Algorithm: Automatic
Invert(ft): 120.000	110.000	Flow: Positive
TClpInitZ(ft): 9999.000	9999.000	Contraction Coef: 0.100
Manning's N:		Expansion Coef: 0.300
Top Clip(ft):		Entrance Loss Coef: 0.000
Bot Clip(ft):		Exit Loss Coef: 0.000
Main XSec: B-2	B-1	Outlet Ctrl Spec: Use dc or tw
AuxElev1(ft): 0.000	0.000	Inlet Ctrl Spec: Use dc
Aux XSec1:		Stabilizer Option: None
AuxElev2(ft): 0.000	0.000	
Aux XSec2:		
Top Width(ft):		
Depth(ft):		
Bot Width(ft):		
LtSdSlp(h/v):		
RtSdSlp(h/v):		

Name: B-3 TO B-2	From Node: B-3	Length(ft): 700.00
Group: DOWN-STREAM-ANA	To Node: B-2	Count: 1

UPSTREAM	DOWNSTREAM	Friction Equation: Automatic
Geometry: Irregular	Irregular	Solution Algorithm: Automatic
Invert(ft): 124.000	120.000	Flow: Both
TClpInitZ(ft): 9999.000	9999.000	Contraction Coef: 0.100
Manning's N:		Expansion Coef: 0.300
Top Clip(ft):		Entrance Loss Coef: 0.000
Bot Clip(ft):		Exit Loss Coef: 0.000
Main XSec: B-3	B-2	Outlet Ctrl Spec: Use dc or tw
AuxElev1(ft): 0.000	0.000	Inlet Ctrl Spec: Use dc
Aux XSec1:		Stabilizer Option: None
AuxElev2(ft): 0.000	0.000	
Aux XSec2:		
Top Width(ft):		
Depth(ft):		
Bot Width(ft):		
LtSdSlp(h/v):		
RtSdSlp(h/v):		

natural channel with stones and weeds

Name: CREEK-C	From Node: RAILROAD-1	Length(ft): 793.00
Group: DOWN-STREAM-ANA	To Node: CONFLUENCE	Count: 1

UPSTREAM	DOWNSTREAM	Friction Equation: Automatic
Geometry: Irregular	Irregular	Solution Algorithm: Automatic
Invert(ft): 115.000	110.000	Flow: Positive
TClpInitZ(ft): 9999.000	9999.000	Contraction Coef: 0.100
Manning's N:		Expansion Coef: 0.300
Top Clip(ft):		Entrance Loss Coef: 0.000
Bot Clip(ft):		Exit Loss Coef: 0.000
Main XSec: C-2	C-1	Outlet Ctrl Spec: Use dc or tw
AuxElev1(ft): 0.000	0.000	Inlet Ctrl Spec: Use dc
Aux XSec1:		Stabilizer Option: None
AuxElev2(ft): 0.000	0.000	
Aux XSec2:		
Top Width(ft):		
Depth(ft):		
Bot Width(ft):		

LtSdSlp(h/v):
 RtSdSlp(h/v):

```

-----
      Name: WEST BRANCH      From Node: CONFLUENCE      Length(ft): 1696.00
      Group: DOWN-STREAM-ANA  To Node: BARINEAU-RD      Count: 1

      UPSTREAM      DOWNSTREAM      Friction Equation: Automatic
      Geometry: Irregular      Irregular      Solution Algorithm: Automatic
      Invert(ft): 104.000      94.000      Flow: Positive
      TCIPInitZ(ft): 9999.000      9999.000      Contraction Coef: 0.100
      Manning's N:      Expansion Coef: 0.300
      Top Clip(ft):      Entrance Loss Coef: 0.000
      Bot Clip(ft):      Exit Loss Coef: 0.000
      Main XSec: A-2      A-1      Outlet Ctrl Spec: Use dc or tw
      AuxElev1(ft): 0.000      0.000      Inlet Ctrl Spec: Use dc
      Aux XSec1:      Stabilizer Option: None
      AuxElev2(ft): 0.000      0.000
      Aux XSec2:
      Top Width(ft):
      Depth(ft):
      Bot Width(ft):
      LtSdSlp(h/v):
      RtSdSlp(h/v):
  
```

=====

```

===== Weirs =====
=====
      Name: BARINEAU-RD-W      From Node: BARINEAU-RD
      Group: DOWN-STREAM-ANA  To Node: POA-BARINEAU
      Flow: Both      Count: 1
      Type: Vertical: Paved      Geometry: Trapezoidal

      Bottom Width(ft): 100.00
      Left Side Slope(h/v): 0.01
      Right Side Slope(h/v): 0.00
      Invert(ft): 101.830
      Control Elevation(ft): 101.830
      Struct Opening Dim(ft): 9999.00

      Bottom Clip(ft): 0.000
      Top Clip(ft): 0.000
      Weir Discharge Coef: 3.200
      Orifice Discharge Coef: 0.600
  
```

TABLE

```

-----
      Name: BETHEL CHURCH-W      From Node: BETHEL-CHURCH-
      Group: DOWN-STREAM-ANA  To Node: D-3
      Flow: Both      Count: 1
      Type: Vertical: Paved      Geometry: Irregular

      XSec: BETHEL-CHURCH-R
      Invert(ft): 151.310
      Control Elevation(ft): 151.310
      Struct Opening Dim(ft): 9999.00

      Bottom Clip(ft): 0.000
      Top Clip(ft): 0.000
      Weir Discharge Coef: 3.200
      Orifice Discharge Coef: 0.600
  
```

TABLE

```

-----
      Name: E-WEIR      From Node: E-SITE
      Group: DOWN-STREAM-ANA  To Node: B-3
      Flow: Both      Count: 1
      Type: Vertical: Mavis      Geometry: Trapezoidal

      Bottom Width(ft): 50.00
      Left Side Slope(h/v): 5.00
      Right Side Slope(h/v): 5.00
      Invert(ft): 126.100
      Control Elevation(ft): 126.100
      Struct Opening Dim(ft): 9999.00
  
```

TABLE

Bottom Clip(ft): 0.000
 Top Clip(ft): 0.000
 Weir Discharge Coef: 3.200
 Orifice Discharge Coef: 0.600

Name: RAIL ROAD-W From Node: D-3
 Group: DOWN-STREAM-ANA To Node: RAILROAD-1
 Flow: Both Count: 1
 Type: Vertical: Fread Geometry: Rectangular

Span(in): 1248.00
 Rise(in): 30.00
 Invert(ft): 126.650
 Control Elevation(ft): 126.650

TABLE

Bottom Clip(in): 0.000
 Top Clip(in): 0.000
 Weir Discharge Coef: 3.200
 Orifice Discharge Coef: 0.600

=====
 Hydrology Simulations
 =====

Name: 100yr-1hr
 Filename: C:\Projects\100yr-1hr.R32

Override Defaults: Yes
 Storm Duration(hrs): 1.00
 Rainfall File: Fdot-1
 Rainfall Amount(in): 4.40

Time(hrs)	Print Inc(min)
2.000	2.00

Name: 100yr-24hr
 Filename: C:\Projects\100yr-24hr.R32

Override Defaults: Yes
 Storm Duration(hrs): 24.00
 Rainfall File: Fdot-24
 Rainfall Amount(in): 10.90

Time(hrs)	Print Inc(min)
24.000	2.00

Name: 100yr-2hr
 Filename: C:\Projects\100yr-2hr.R32

Override Defaults: Yes
 Storm Duration(hrs): 2.00
 Rainfall File: Fdot-2
 Rainfall Amount(in): 5.80

Time(hrs)	Print Inc(min)
2.000	2.00

Name: 100yr-4hr
 Filename: C:\Projects\100yr-4hr.R32

Override Defaults: Yes
 Storm Duration(hrs): 4.00
 Rainfall File: Fdot-4
 Rainfall Amount(in): 7.20

Time(hrs)	Print Inc(min)
4.000	2.00

Name: 100yr-8hr
 Filename: C:\Projects\100yr-8hr.R32

Override Defaults: Yes
Storm Duration(hrs): 8.00
Rainfall File: Fdot-8
Rainfall Amount(in): 8.90

Time(hrs)	Print Inc(min)
8.000	2.00

Name: 10yr-1hr
Filename: C:\Projects\10yr-1hr.R32

Override Defaults: Yes
Storm Duration(hrs): 1.00
Rainfall File: Fdot-1
Rainfall Amount(in): 3.20

Time(hrs)	Print Inc(min)
2.000	2.00

Name: 10yr-24hr
Filename: C:\Projects\10yr-24hr.R32

Override Defaults: Yes
Storm Duration(hrs): 24.00
Rainfall File: Fdot-24
Rainfall Amount(in): 7.50

Time(hrs)	Print Inc(min)
24.000	2.00

Name: 10yr-2hr
Filename: C:\Projects\10yr-2hr.R32

Override Defaults: Yes
Storm Duration(hrs): 2.00
Rainfall File: Fdot-2
Rainfall Amount(in): 4.10

Time(hrs)	Print Inc(min)
2.000	2.00

Name: 10yr-4hr
Filename: C:\Projects\10yr-4hr.R32

Override Defaults: Yes
Storm Duration(hrs): 4.00
Rainfall File: Fdot-4
Rainfall Amount(in): 5.00

Time(hrs)	Print Inc(min)
4.000	2.00

Name: 10yr-8hr
Filename: C:\Projects\10yr-8hr.R32

Override Defaults: Yes
Storm Duration(hrs): 8.00
Rainfall File: Fdot-8
Rainfall Amount(in): 6.20

Time(hrs)	Print Inc(min)
8.000	2.00

Name: 25YR-1HR
Filename: C:\Projects\25YR-1HR.R32

Override Defaults: Yes
Storm Duration(hrs): 1.00
Rainfall File: Fdot-1
Rainfall Amount(in): 3.70

Time(hrs)	Print Inc(min)
2.000	2.00

Name: 25YR-24HR
Filename: C:\Projects\25YR-24HR.R32

Override Defaults: Yes
Storm Duration(hrs): 24.00
Rainfall File: Fdot-24
Rainfall Amount(in): 8.50

Time(hrs)	Print Inc(min)
24.000	2.00

Name: 25YR-2HR
Filename: C:\Projects\25YR-2HR.R32

Override Defaults: Yes
Storm Duration(hrs): 2.00
Rainfall File: Fdot-2
Rainfall Amount(in): 4.70

Time(hrs)	Print Inc(min)
2.000	2.00

Name: 25YR-4HR
Filename: C:\Projects\25YR-4HR.R32

Override Defaults: Yes
Storm Duration(hrs): 4.00
Rainfall File: Fdot-4
Rainfall Amount(in): 5.90

Time(hrs)	Print Inc(min)
4.000	2.00

Name: 25YR-8HR
Filename: C:\Projects\25YR-8HR.R32

Override Defaults: Yes
Storm Duration(hrs): 8.00
Rainfall File: Fdot-8
Rainfall Amount(in): 7.40

Time(hrs)	Print Inc(min)
8.000	2.00

Name: 2yr-1hr
Filename: C:\Projects\2yr-1hr.R32

Override Defaults: Yes
Storm Duration(hrs): 1.00
Rainfall File: Fdot-1
Rainfall Amount(in): 2.30

Time(hrs)	Print Inc(min)
2.000	2.00

Name: 2yr-24hr
Filename: C:\Projects\2yr-24hr.R32

Override Defaults: Yes
Storm Duration(hrs): 24.00
Rainfall File: Fdot-24
Rainfall Amount(in): 4.70

Time(hrs)	Print Inc(min)
24.000	2.00

Name: 2yr-2hr
Filename: C:\Projects\2yr-2hr.R32

Override Defaults: Yes
Storm Duration(hrs): 2.00
Rainfall File: Fdot-2
Rainfall Amount(in): 3.00

Time(hrs)	Print Inc(min)
2.000	2.00

Name: 2yr-4hr
Filename: C:\Projects\2yr-4hr.R32

Override Defaults: Yes
Storm Duration(hrs): 4.00
Rainfall File: Fdot-4
Rainfall Amount(in): 3.50

Time(hrs)	Print Inc(min)
4.000	2.00

Name: 2yr-8hr
Filename: C:\Projects\2yr-8hr.R32

Override Defaults: Yes
Storm Duration(hrs): 8.00
Rainfall File: Fdot-8
Rainfall Amount(in): 4.20

Time(hrs)	Print Inc(min)
8.000	2.00

Name: 50yr-1hr
Filename: C:\Projects\50yr-1hr.R32

Override Defaults: Yes
Storm Duration(hrs): 1.00
Rainfall File: Fdot-1
Rainfall Amount(in): 4.00

Time(hrs)	Print Inc(min)
2.000	2.00

Name: 50yr-24hr
Filename: C:\Projects\50yr-24hr.R32

Override Defaults: Yes
Storm Duration(hrs): 24.00
Rainfall File: Fdot-24
Rainfall Amount(in): 9.60

Time(hrs)	Print Inc(min)
24.000	2.00

Name: 50yr-2hr
Filename: C:\Projects\50yr-2hr.R32

Override Defaults: Yes
Storm Duration(hrs): 2.00
Rainfall File: Fdot-2
Rainfall Amount(in): 5.20

Time(hrs)	Print Inc(min)
2.000	2.00

Name: 50yr-4hr
Filename: C:\Projects\50yr-4hr.R32

Override Defaults: Yes

Storm Duration(hrs): 4.00
Rainfall File: Fdot-4
Rainfall Amount(in): 6.40

Time(hrs)	Print Inc(min)
4.000	2.00

Name: 50yr-8hr
Filename: C:\Projects\50yr-8hr.R32

Override Defaults: Yes
Storm Duration(hrs): 8.00
Rainfall File: Fdot-8
Rainfall Amount(in): 8.00

Time(hrs)	Print Inc(min)
8.000	2.00

Name: 5yr-1hr
Filename: C:\Projects\5yr-1hr.R32

Override Defaults: Yes
Storm Duration(hrs): 1.00
Rainfall File: Fdot-1
Rainfall Amount(in): 2.80

Time(hrs)	Print Inc(min)
2.000	2.00

Name: 5yr-24hr
Filename: C:\Projects\5yr-24hr.R32

Override Defaults: Yes
Storm Duration(hrs): 24.00
Rainfall File: Fdot-24
Rainfall Amount(in): 6.40

Time(hrs)	Print Inc(min)
24.000	2.00

Name: 5yr-2hr
Filename: C:\Projects\5yr-2hr.R32

Override Defaults: Yes
Storm Duration(hrs): 2.00
Rainfall File: Fdot-2
Rainfall Amount(in): 3.60

Time(hrs)	Print Inc(min)
2.000	2.00

Name: 5yr-4hr
Filename: C:\Projects\5yr-4hr.R32

Override Defaults: Yes
Storm Duration(hrs): 4.00
Rainfall File: Fdot-4
Rainfall Amount(in): 4.40

Time(hrs)	Print Inc(min)
4.000	2.00

Name: 5yr-8hr
Filename: C:\Projects\5yr-8hr.R32

Override Defaults: Yes
Storm Duration(hrs): 8.00
Rainfall File: Fdot-8
Rainfall Amount(in): 5.50

Time(hrs)	Print Inc(min)
-----------	----------------

 8.000 2.00

==== Routing Simulations =====

Name: 100yr-1hr Hydrology Sim: 100yr-1hr
 Filename: C:\Projects\100yr-1hr.I32

Execute: Yes Restart: No Patch: No
 Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
 Time Step Optimizer: 10.000
 Start Time(hrs): 0.000 End Time(hrs): 2.00
 Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
 Boundary Stages: Boundary Flows:

Time(hrs) Print Inc(min)

 2.000 2.000

Group Run

 DOWN-STREAM-ANA Yes

 Name: 100yr-24hr Hydrology Sim: 100yr-24hr
 Filename: C:\Projects\100yr-24hr.I32

Execute: Yes Restart: No Patch: No
 Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
 Time Step Optimizer: 10.000
 Start Time(hrs): 0.000 End Time(hrs): 24.00
 Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
 Boundary Stages: Boundary Flows:

Time(hrs) Print Inc(min)

 24.000 2.000

Group Run

 DOWN-STREAM-ANA Yes

 Name: 100yr-2hr Hydrology Sim: 100yr-2hr
 Filename: C:\Projects\100yr-2hr.I32

Execute: Yes Restart: No Patch: No
 Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
 Time Step Optimizer: 10.000
 Start Time(hrs): 0.000 End Time(hrs): 2.00
 Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
 Boundary Stages: Boundary Flows:

Time(hrs) Print Inc(min)

 2.000 2.000

Group Run

 DOWN-STREAM-ANA Yes

 Name: 100yr-4hr Hydrology Sim: 100yr-4hr
 Filename: C:\Projects\100yr-4hr.I32

Execute: Yes Restart: No Patch: No

DOWNSTREAM ANALYSIS-PRE-DEVELOPMENT-INPUT

Alternative: No

Max Delta Z(ft): 1.00	Delta Z Factor: 0.00500
Time Step Optimizer: 10.000	
Start Time(hrs): 0.000	End Time(hrs): 4.00
Min Calc Time(sec): 0.5000	Max Calc Time(sec): 60.0000
Boundary Stages:	Boundary Flows:

Time(hrs)	Print Inc(min)
-----	-----
4.000	2.000

Group	Run
-----	-----
DOWN-STREAM-ANA	Yes

Name: 100yr-8hr	Hydrology Sim: 100yr-8hr
Filename: C:\Projects\100yr-8hr.I32	

Execute: Yes	Restart: No	Patch: No
Alternative: No		

Max Delta Z(ft): 1.00	Delta Z Factor: 0.00500
Time Step Optimizer: 10.000	
Start Time(hrs): 0.000	End Time(hrs): 8.00
Min Calc Time(sec): 0.5000	Max Calc Time(sec): 60.0000
Boundary Stages:	Boundary Flows:

Time(hrs)	Print Inc(min)
-----	-----
8.000	2.000

Group	Run
-----	-----
DOWN-STREAM-ANA	Yes

Name: 10yr-1hr	Hydrology Sim: 10YR-1HR
Filename: C:\Projects\10yr-1hr.I32	

Execute: Yes	Restart: No	Patch: No
Alternative: No		

Max Delta Z(ft): 1.00	Delta Z Factor: 0.00500
Time Step Optimizer: 10.000	
Start Time(hrs): 0.000	End Time(hrs): 2.00
Min Calc Time(sec): 0.5000	Max Calc Time(sec): 60.0000
Boundary Stages:	Boundary Flows:

Time(hrs)	Print Inc(min)
-----	-----
2.000	2.000

Group	Run
-----	-----
DOWN-STREAM-ANA	Yes

Name: 10yr-24hr	Hydrology Sim: 10YR-24HR
Filename: C:\Projects\10yr-24hr.I32	

Execute: Yes	Restart: No	Patch: No
Alternative: No		

Max Delta Z(ft): 1.00	Delta Z Factor: 0.00500
Time Step Optimizer: 10.000	
Start Time(hrs): 0.000	End Time(hrs): 24.00
Min Calc Time(sec): 0.5000	Max Calc Time(sec): 60.0000
Boundary Stages:	Boundary Flows:

Time(hrs)	Print Inc(min)
-----	-----

DOWNSTREAM ANALYSIS-PRE-DEVELOPMENT-INPUT

24.000 2.000
Group Run

DOWN-STREAM-ANA Yes

Name: 10yr-2hr Hydrology Sim: 10YR-2HR
Filename: C:\Projects\10yr-2hr.I32
Execute: Yes Restart: No Patch: No
Alternative: No
Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000 End Time(hrs): 2.00
Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
Boundary Stages: Boundary Flows:

Time(hrs) Print Inc(min)

2.000 2.000
Group Run

DOWN-STREAM-ANA Yes

Name: 10yr-4hr Hydrology Sim: 10YR-4HR
Filename: C:\Projects\10yr-4hr.I32
Execute: Yes Restart: No Patch: No
Alternative: No
Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000 End Time(hrs): 4.00
Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
Boundary Stages: Boundary Flows:

Time(hrs) Print Inc(min)

4.000 2.000
Group Run

DOWN-STREAM-ANA Yes

Name: 10yr-8hr Hydrology Sim: 10YR-8HR
Filename: C:\Projects\10yr-8hr.I32
Execute: Yes Restart: No Patch: No
Alternative: No
Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000 End Time(hrs): 8.00
Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
Boundary Stages: Boundary Flows:

Time(hrs) Print Inc(min)

8.000 2.000
Group Run

DOWN-STREAM-ANA Yes

Name: 25yr-1hr Hydrology Sim: 25YR-1HR
Filename: C:\Projects\25yr-1hr.I32

Execute: Yes	Restart: No	Patch: No
Alternative: No		
Max Delta Z(ft): 1.00		Delta Z Factor: 0.00500
Time Step Optimizer: 10.000		
Start Time(hrs): 0.000		End Time(hrs): 2.00
Min Calc Time(sec): 0.5000	Max	Calc Time(sec): 60.0000
Boundary Stages:		Boundary Flows:

Time(hrs)	Print Inc(min)
-----	-----
2.000	2.000

Group	Run
-----	-----
DOWN-STREAM-ANA	Yes

Name: 25yr-24hr	Hydrology Sim: 25YR-24HR
Filename: C:\Projects\25yr-24hr.I32	

Execute: Yes	Restart: No	Patch: No
Alternative: No		
Max Delta Z(ft): 1.00		Delta Z Factor: 0.00500
Time Step Optimizer: 10.000		
Start Time(hrs): 0.000		End Time(hrs): 24.00
Min Calc Time(sec): 0.5000	Max	Calc Time(sec): 60.0000
Boundary Stages:		Boundary Flows:

Time(hrs)	Print Inc(min)
-----	-----
24.000	2.000

Group	Run
-----	-----
DOWN-STREAM-ANA	Yes

Name: 25yr-2hr	Hydrology Sim: 25YR-2HR
Filename: C:\Projects\25yr-2hr.I32	

Execute: Yes	Restart: No	Patch: No
Alternative: No		
Max Delta Z(ft): 1.00		Delta Z Factor: 0.00500
Time Step Optimizer: 10.000		
Start Time(hrs): 0.000		End Time(hrs): 2.00
Min Calc Time(sec): 0.5000	Max	Calc Time(sec): 60.0000
Boundary Stages:		Boundary Flows:

Time(hrs)	Print Inc(min)
-----	-----
2.000	2.000

Group	Run
-----	-----
DOWN-STREAM-ANA	Yes

Name: 25yr-4hr	Hydrology Sim: 25YR-4HR
Filename: C:\Projects\25yr-4hr.I32	

Execute: Yes	Restart: No	Patch: No
Alternative: No		
Max Delta Z(ft): 1.00		Delta Z Factor: 0.00500
Time Step Optimizer: 10.000		
Start Time(hrs): 0.000		End Time(hrs): 4.00
Min Calc Time(sec): 0.5000	Max	Calc Time(sec): 60.0000
Boundary Stages:		Boundary Flows:

Time(hrs)	Print Inc(min)
4.000	2.000

Group	Run
DOWN-STREAM-ANA	Yes

Name: 25yr-8hr	Hydrology Sim: 25YR-8HR
Filename: C:\Projects\25yr-8hr.I32	
Execute: Yes	Restart: No
Alternative: No	Patch: No
Max Delta Z(ft): 1.00	Delta Z Factor: 0.00500
Time Step Optimizer: 10.000	
Start Time(hrs): 0.000	End Time(hrs): 8.00
Min Calc Time(sec): 0.5000	Max Calc Time(sec): 60.0000
Boundary Stages:	Boundary Flows:

Time(hrs)	Print Inc(min)
8.000	2.000

Group	Run
DOWN-STREAM-ANA	Yes

Name: 2yr-1hr	Hydrology Sim: 2YR-1HR
Filename: C:\Projects\2yr-1hr.I32	
Execute: Yes	Restart: No
Alternative: No	Patch: No
Max Delta Z(ft): 1.00	Delta Z Factor: 0.00500
Time Step Optimizer: 10.000	
Start Time(hrs): 0.000	End Time(hrs): 2.00
Min Calc Time(sec): 0.5000	Max Calc Time(sec): 60.0000
Boundary Stages:	Boundary Flows:

Time(hrs)	Print Inc(min)
2.000	2.000

Group	Run
DOWN-STREAM-ANA	Yes

Name: 2yr-24hr	Hydrology Sim: 2YR-24HR
Filename: C:\Projects\2yr-24hr.I32	
Execute: Yes	Restart: No
Alternative: No	Patch: No
Max Delta Z(ft): 1.00	Delta Z Factor: 0.00500
Time Step Optimizer: 10.000	
Start Time(hrs): 0.000	End Time(hrs): 24.00
Min Calc Time(sec): 0.5000	Max Calc Time(sec): 60.0000
Boundary Stages:	Boundary Flows:

Time(hrs)	Print Inc(min)
24.000	2.000

Group	Run
DOWN-STREAM-ANA	Yes

Name: 2yr-2hr Hydrology Sim: 2YR-2HR
Filename: C:\Projects\2yr-2hr.I32

Execute: Yes Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000 End Time(hrs): 2.00
Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
Boundary Stages: Boundary Flows:

Time(hrs) Print Inc(min)

2.000 2.000

Group Run

DOWN-STREAM-ANA Yes

Name: 2yr-4hr Hydrology Sim: 2YR-4HR
Filename: C:\Projects\2yr-4hr.I32

Execute: Yes Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000 End Time(hrs): 4.00
Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
Boundary Stages: Boundary Flows:

Time(hrs) Print Inc(min)

4.000 2.000

Group Run

DOWN-STREAM-ANA Yes

Name: 2yr-8hr Hydrology Sim: 2YR-8HR
Filename: C:\Projects\2yr-8hr.I32

Execute: Yes Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000 End Time(hrs): 8.00
Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
Boundary Stages: Boundary Flows:

Time(hrs) Print Inc(min)

8.000 2.000

Group Run

DOWN-STREAM-ANA Yes

Name: 50yr-1hr Hydrology Sim: 50YR-1HR
Filename: C:\Projects\50yr-1hr.I32

Execute: Yes Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000 End Time(hrs): 2.00
Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
Boundary Stages: Boundary Flows:

DOWNSTREAM ANALYSIS-PRE-DEVELOPMENT-INPUT

Time(hrs)	Print Inc(min)
2.000	2.000

Group	Run
DOWN-STREAM-ANA	Yes

Name: 50yr-24hr	Hydrology Sim: 50YR-24HR
Filename: C:\Projects\50yr-24hr.I32	
Execute: Yes	Restart: No
Alternative: No	Patch: No
Max Delta Z(ft): 1.00	Delta Z Factor: 0.00500
Time Step Optimizer: 10.000	
Start Time(hrs): 0.000	End Time(hrs): 24.00
Min Calc Time(sec): 0.5000	Max Calc Time(sec): 60.0000
Boundary Stages:	Boundary Flows:

Time(hrs)	Print Inc(min)
24.000	2.000

Group	Run
DOWN-STREAM-ANA	Yes

Name: 50yr-2hr	Hydrology Sim: 50YR-2HR
Filename: C:\Projects\50yr-2hr.I32	
Execute: Yes	Restart: No
Alternative: No	Patch: No
Max Delta Z(ft): 1.00	Delta Z Factor: 0.00500
Time Step Optimizer: 10.000	
Start Time(hrs): 0.000	End Time(hrs): 2.00
Min Calc Time(sec): 0.5000	Max Calc Time(sec): 60.0000
Boundary Stages:	Boundary Flows:

Time(hrs)	Print Inc(min)
2.000	2.000

Group	Run
DOWN-STREAM-ANA	Yes

Name: 50yr-4hr	Hydrology Sim: 50YR-4HR
Filename: C:\Projects\50yr-4hr.I32	
Execute: Yes	Restart: No
Alternative: No	Patch: No
Max Delta Z(ft): 1.00	Delta Z Factor: 0.00500
Time Step Optimizer: 10.000	
Start Time(hrs): 0.000	End Time(hrs): 4.00
Min Calc Time(sec): 0.5000	Max Calc Time(sec): 60.0000
Boundary Stages:	Boundary Flows:

Time(hrs)	Print Inc(min)
4.000	2.000

Group	Run
DOWN-STREAM-ANA	Yes

Name: 50yr-8hr Hydrology Sim: 50YR-8HR
 Filename: C:\Projects\50yr-8hr.I32

Execute: Yes Restart: No Patch: No
 Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
 Time Step Optimizer: 10.000
 Start Time(hrs): 0.000 End Time(hrs): 8.00
 Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
 Boundary Stages: Boundary Flows:

Time(hrs) Print Inc(min)

 8.000 2.000

Group Run

 DOWN-STREAM-ANA Yes

Name: 5yr-1hr Hydrology Sim: 5YR-1HR
 Filename: C:\Projects\5yr-1hr.I32

Execute: Yes Restart: No Patch: No
 Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
 Time Step Optimizer: 10.000
 Start Time(hrs): 0.000 End Time(hrs): 2.00
 Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
 Boundary Stages: Boundary Flows:

Time(hrs) Print Inc(min)

 2.000 2.000

Group Run

 DOWN-STREAM-ANA Yes

Name: 5yr-24hr Hydrology Sim: 5YR-24HR
 Filename: C:\Projects\5yr-24hr.I32

Execute: Yes Restart: No Patch: No
 Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
 Time Step Optimizer: 10.000
 Start Time(hrs): 0.000 End Time(hrs): 24.00
 Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
 Boundary Stages: Boundary Flows:

Time(hrs) Print Inc(min)

 24.000 2.000

Group Run

 DOWN-STREAM-ANA Yes

Name: 5yr-2hr Hydrology Sim: 5YR-2HR
 Filename: C:\Projects\5yr-2hr.I32

Execute: Yes Restart: No Patch: No
 Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
 Time Step Optimizer: 10.000
 Start Time(hrs): 0.000 End Time(hrs): 2.00

Min Calc Time(sec): 0.5000
 Boundary Stages:

Max Calc Time(sec): 60.0000
 Boundary Flows:

Time(hrs) Print Inc(min)

 2.000 2.000

Group Run

 DOWN-STREAM-ANA Yes

Name: 5yr-4hr Hydrology Sim: 5YR-4HR
 Filename: C:\Projects\5yr-4hr.I32

Execute: Yes Restart: No Patch: No
 Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
 Time Step Optimizer: 10.000
 Start Time(hrs): 0.000 End Time(hrs): 4.00
 Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
 Boundary Stages: Boundary Flows:

Time(hrs) Print Inc(min)

 4.000 2.000

Group Run

 DOWN-STREAM-ANA Yes

Name: 5yr-8hr Hydrology Sim: 5YR-8HR
 Filename: C:\Projects\5yr-8hr.I32

Execute: Yes Restart: No Patch: No
 Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
 Time Step Optimizer: 10.000
 Start Time(hrs): 0.000 End Time(hrs): 8.00
 Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
 Boundary Stages: Boundary Flows:

Time(hrs) Print Inc(min)

 8.000 2.000

Group Run

 DOWN-STREAM-ANA Yes

=====
 === Boundary Conditions ===
 =====

Name: Node: E-South Type: Stage

Time(hrs) Stage(ft)

 0.000 85.000
 900.000 85.000

Downstream Analysis Post-Development Input

Unit Hydrograph: UH323	Peaking Factor: 323.0
Rainfall File:	Storm Duration(hrs): 0.00
Rainfall Amount(in): 0.000	Time of Conc(min): 42.00
Area(ac): 83.660	Time Shift(hrs): 0.00
Curve Number: 32.70	Max Allowable Q(cfs): 999999.000
DCIA(%): 0.00	

Unit Hydrograph: UH323	Peaking Factor: 323.0
Rainfall File:	Storm Duration(hrs): 0.00
Rainfall Amount(in): 0.000	Time of Conc(min): 30.00
Area(ac): 38.940	Time Shift(hrs): 0.00
Curve Number: 31.00	Max Allowable Q(cfs): 999999.000
DCIA(%): 0.00	

Unit Hydrograph: UH323	Peaking Factor: 323.0
Rainfall File:	Storm Duration(hrs): 0.00
Rainfall Amount(in): 0.000	Time of Conc(min): 10.00
Area(ac): 31.480	Time Shift(hrs): 0.00
Curve Number: 37.10	Max Allowable Q(cfs): 999999.000
DCIA(%): 0.00	

Unit Hydrograph: UH323	Peaking Factor: 323.0
Rainfall File:	Storm Duration(hrs): 0.00
Rainfall Amount(in): 0.000	Time of Conc(min): 33.00
Area(ac): 23.280	Time Shift(hrs): 0.00
Curve Number: 31.00	Max Allowable Q(cfs): 999999.000
DCIA(%): 0.00	

Unit Hydrograph: UH323	Peaking Factor: 323.0
Rainfall File:	Storm Duration(hrs): 0.00
Rainfall Amount(in): 0.000	Time of Conc(min): 32.00
Area(ac): 92.770	Time Shift(hrs): 0.00
Curve Number: 47.90	Max Allowable Q(cfs): 999999.000
DCIA(%): 0.00	

Unit Hydrograph: UH323	Peaking Factor: 323.0
Rainfall File:	Storm Duration(hrs): 0.00
Rainfall Amount(in): 0.000	Time of Conc(min): 5.00
Area(ac): 2.140	Time Shift(hrs): 0.00
Curve Number: 94.40	Max Allowable Q(cfs): 999999.000
DCIA(%): 0.00	

Use East side in post-development condition

Name: P-WEST-POST	Node: E-SWMF	Status: Onsite
Group: DOWN-STREAM-ANA	Type: SCS Unit Hydrograph CN	
Unit Hydrograph: Uh323	Peaking Factor: 323.0	
Rainfall File:	Storm Duration(hrs): 0.00	
Rainfall Amount(in): 0.000	Time of Conc(min): 5.00	
Area(ac): 4.920	Time Shift(hrs): 0.00	
Curve Number: 92.70	Max Allowable Q(cfs): 999999.000	
DCIA(%): 0.00		

Name: TRANS RD	Node: TRANS RD	Status: Onsite
Group: DOWN-STREAM-ANA	Type: SCS Unit Hydrograph CN	
Unit Hydrograph: Uh323	Peaking Factor: 323.0	
Rainfall File:	Storm Duration(hrs): 0.00	
Rainfall Amount(in): 0.000	Time of Conc(min): 44.00	
Area(ac): 67.110	Time Shift(hrs): 0.00	
Curve Number: 33.80	Max Allowable Q(cfs): 999999.000	
DCIA(%): 0.00		

==== Nodes =====

Name: B-2	Base Flow(cfs): 0.000	Init Stage(ft): 120.000
Group: DOWN-STREAM-ANA		Warn Stage(ft): 125.000
Type: Stage/Area		

Assumed node to have some storage, from depression near converge of contours
 Estimate storage amount

Stage(ft)	Area(ac)
120.000	0.2000
122.000	1.0000

Name: B-3	Base Flow(cfs): 0.000	Init Stage(ft): 124.000
Group: DOWN-STREAM-ANA		Warn Stage(ft): 130.000
Type: Stage/Area		

Stage(ft)	Area(ac)
124.000	0.0001
129.800	0.0002

Name: BARINEAU-RD	Base Flow(cfs): 0.000	Init Stage(ft): 93.640
Group: DOWN-STREAM-ANA		Warn Stage(ft): 102.000
Type: Stage/Area		

Assumed Barineau Rd node to have some minor storage, from depression
 Estimate small storage amount
 FEMA Base Flood Elevation (BFE) = 102

Stage(ft)	Area(ac)
93.640	0.0100
94.000	0.0150
95.000	0.2500
96.000	0.5000

Name: BETHEL-CHURCH-	Base Flow(cfs): 0.000	Init Stage(ft): 142.000
Group: DOWN-STREAM-ANA		Warn Stage(ft): 155.000
Type: Stage/Area		

EXISTING POND AT BETHEL CHURCH RD

Stage(ft)	Area(ac)
142.000	3.2170
144.000	3.6500
146.000	4.2230
148.000	4.9510
150.000	5.7120

152.000	6.4080
154.000	7.3200

```

-----
Name: CONFLUENCE      Base Flow(cfs): 0.000      Init Stage(ft): 104.000
Group: DOWN-STREAM-ANA  Warn Stage(ft): 107.500
Type: Stage/Area
  
```

Assumed Confluence to have some minor storage

Stage(ft)	Area(ac)
104.000	0.0010
105.000	0.0020
106.000	0.0030
107.000	0.0050
108.000	0.2000
110.000	0.6000

```

-----
Name: D-3      Base Flow(cfs): 0.000      Init Stage(ft): 115.000
Group: DOWN-STREAM-ANA  Warn Stage(ft): 126.000
Type: Stage/Area
  
```

Floodplain Depression 1

Stage(ft)	Area(ac)
115.000	0.5050
117.000	1.3070
119.000	3.1890

```

-----
Name: E-SWMF      Base Flow(cfs): 0.000      Init Stage(ft): 125.800
Group: DOWN-STREAM-ANA  Warn Stage(ft): 131.000
Type: Stage/Area
  
```

Existing Pond

Stage(ft)	Area(ac)
125.800	0.1150
126.000	0.3450
127.000	0.5050
128.000	0.6060
129.000	0.7090
130.000	0.8060
131.000	0.9050

```

-----
Name: POA-BARINEAU  Base Flow(cfs): 0.000      Init Stage(ft): 92.000
Group: DOWN-STREAM-ANA  Warn Stage(ft): 95.000
Type: Time/Stage
  
```

Time(hrs)	Stage(ft)
0.00	92.000
99999.00	92.000

```

-----
Name: RAILROAD-1    Base Flow(cfs): 0.000      Init Stage(ft): 115.000
Group: DOWN-STREAM-ANA  Warn Stage(ft): 125.000
Type: Stage/Area
  
```

Stage(ft)	Area(ac)
115.000	0.0000
129.800	0.0001

```

-----
Name: TRANS RD      Base Flow(cfs): 0.000      Init Stage(ft): 110.000
Group: DOWN-STREAM-ANA  Warn Stage(ft): 112.000
Type: Stage/Area
  
```

Assumed node to have some storage, from depression near dirt road crossing
 Estimate storage amount

Stage(ft)	Area(ac)
-----	-----

110.000 0.0900
 112.000 0.3300

==== Cross Sections =====

Name: A-1 Group: DOWN-STREAM-ANA
 Encroachment: No

Winding channel paths and ineffective slopes

Station(ft)	Elevation(ft)	Manning's N
-91.190	102.000	0.045000
-68.370	100.000	0.045000
-37.150	98.000	0.045000
-8.670	96.000	0.045000
0.000	94.000	0.045000
5.400	96.000	0.045000
41.370	98.000	0.045000
71.720	100.000	0.045000

Name: A-2 Group: DOWN-STREAM-ANA
 Encroachment: No

Station(ft)	Elevation(ft)	Manning's N
-131.080	110.000	0.035000
-105.180	108.000	0.035000
-70.620	106.000	0.035000
0.000	104.000	0.035000
57.950	106.000	0.035000
81.130	108.000	0.035000
111.500	110.000	0.035000

Name: B-0 Group: DOWN-STREAM-ANA
 Encroachment: No

Station(ft)	Elevation(ft)	Manning's N
-58.430	108.000	0.035000
0.000	106.000	0.035000
77.220	108.000	0.035000

Name: B-1 Group: DOWN-STREAM-ANA
 Encroachment: No

Station(ft)	Elevation(ft)	Manning's N
-171.540	112.000	0.035000
-23.320	110.000	0.035000
18.470	110.000	0.035000
126.390	112.000	0.035000

Name: B-2 Group: DOWN-STREAM-ANA
 Encroachment: No

Station(ft)	Elevation(ft)	Manning's N
-18.010	126.000	0.035000
-13.770	124.000	0.035000
-10.120	122.000	0.035000
-4.890	120.000	0.035000
5.480	120.000	0.035000
10.460	122.000	0.035000
15.480	124.000	0.035000
22.400	126.000	0.035000

Name: B-3 Group: DOWN-STREAM-ANA

Encroachment: No

Station(ft)	Elevation(ft)	Manning's N
-234.890	128.000	0.035000
-186.500	126.000	0.035000
-111.730	124.000	0.035000
46.820	124.000	0.035000
113.870	124.000	0.035000
134.220	124.000	0.035000
177.520	126.000	0.035000
238.820	128.000	0.035000

Name: BETHEL-CHURCH-R Group: DOWN-STREAM-ANA
 Encroachment: No

BETHEL CHURCH RD AS WEIR

Station(ft)	Elevation(ft)	Manning's N
-84.000	152.330	0.012000
-50.540	151.990	0.012000
0.000	151.310	0.012000
30.570	151.140	0.012000
72.470	150.940	0.012000

Name: C-1 Group: DOWN-STREAM-ANA
 Encroachment: No

Station(ft)	Elevation(ft)	Manning's N
-149.430	114.000	0.035000
-59.040	112.000	0.035000
0.000	110.000	0.035000
64.880	112.000	0.035000
117.190	114.000	0.035000

Name: C-2 Group: DOWN-STREAM-ANA
 Encroachment: No

Station(ft)	Elevation(ft)	Manning's N
-182.370	120.000	0.035000
-142.530	118.000	0.035000
-61.050	116.000	0.035000
0.000	115.000	0.035000
69.860	116.000	0.035000
114.690	118.000	0.035000
139.950	120.000	0.035000

Name: D-1 Group: DOWN-STREAM-ANA
 Encroachment: No

Station(ft)	Elevation(ft)	Manning's N
-96.450	120.000	0.035000
-61.000	120.000	0.035000
0.000	118.000	0.035000
56.200	120.000	0.035000
96.490	122.000	0.035000

Name: D-2 Group: DOWN-STREAM-ANA
 Encroachment: No

Station(ft)	Elevation(ft)	Manning's N
-101.030	124.000	0.035000
70.410	122.000	0.035000

DOWNSTREAM ANALYSIS-POST

76.980	122.000	0.035000
151.890	124.000	0.035000

==== Pipes =====

Name: BETHEL-CHURCH-P	From Node: BETHEL-CHURCH-	Length(ft): 40.26
Group: DOWN-STREAM-ANA	To Node: D-3	Count: 1
UPSTREAM	DOWNSTREAM	Friction Equation: Automatic
Geometry: Circular	Circular	Solution Algorithm: Most Restrictive
Span(in): 24.00	24.00	Flow: Both
Rise(in): 24.00	24.00	Entrance Loss Coef: 0.00
Invert(ft): 148.500	148.200	Exit Loss Coef: 1.00
Manning's N: 0.120000	0.120000	Bend Loss Coef: 0.00
Top Clip(in): 0.000	0.000	Outlet Ctrl Spec: Use dc or tw
Bot Clip(in): 0.000	0.000	Inlet Ctrl Spec: Use dc
		Stabilizer Option: None

Upstream FHWA Inlet Edge Description:
 Circular CMP: Headwall

Downstream FHWA Inlet Edge Description:
 Circular CMP: Headwall

Name: POA	From Node: BARINEAU-RD	Length(ft): 28.08
Group: DOWN-STREAM-ANA	To Node: POA-BARINEAU	Count: 1
UPSTREAM	DOWNSTREAM	Friction Equation: Automatic
Geometry: Rectangular	Rectangular	Solution Algorithm: Most Restrictive
Span(in): 92.40	92.40	Flow: Both
Rise(in): 48.00	48.00	Entrance Loss Coef: 0.00
Invert(ft): 93.640	93.360	Exit Loss Coef: 1.00
Manning's N: 0.120000	0.120000	Bend Loss Coef: 0.00
Top Clip(in): 0.000	0.000	Outlet Ctrl Spec: Use dc or tw
Bot Clip(in): 0.000	0.000	Inlet Ctrl Spec: Use dc
		Stabilizer Option: None

Upstream FHWA Inlet Edge Description:
 Rectangular Box: 3/4" chamfers; 30° skewed headwall

Downstream FHWA Inlet Edge Description:
 Rectangular Box: 0° wingwall flares

Name: RAIL-ROAD-CROSS	From Node: D-3	Length(ft): 49.00
Group: DOWN-STREAM-ANA	To Node: RAILROAD-1	Count: 1
UPSTREAM	DOWNSTREAM	Friction Equation: Automatic
Geometry: Circular	Circular	Solution Algorithm: Automatic
Span(in): 42.00	42.00	Flow: Positive
Rise(in): 42.00	42.00	Entrance Loss Coef: 0.00
Invert(ft): 115.880	115.800	Exit Loss Coef: 1.00
Manning's N: 0.120000	0.120000	Bend Loss Coef: 0.00
Top Clip(in): 0.000	0.000	Outlet Ctrl Spec: Use dc or tw
Bot Clip(in): 0.000	0.000	Inlet Ctrl Spec: Use dc
		Stabilizer Option: None

Upstream FHWA Inlet Edge Description:
 Circular Concrete: Square edge w/ headwall

Downstream FHWA Inlet Edge Description:
 Circular Concrete: Groove end projecting

==== Channels =====

Name: B-1 TO CONFLUEN	From Node: TRANS RD	Length(ft): 269.67
Group: DOWN-STREAM-ANA	To Node: CONFLUENCE	Count: 1
UPSTREAM	DOWNSTREAM	Friction Equation: Automatic

DOWNSTREAM ANALYSIS-POST

Geometry: Irregular	Irregular	Solution Algorithm: Automatic
Invert(ft): 110.000	106.000	Flow: Positive
TClpInitZ(ft): 9999.000	9999.000	Contraction Coef: 0.100
Manning's N:		Expansion Coef: 0.300
Top Clip(ft):		Entrance Loss Coef: 0.000
Bot Clip(ft):		Exit Loss Coef: 0.000
Main XSec: B-1	B-0	Outlet Ctrl Spec: Use dc or tw
AuxElev1(ft): 0.000	0.000	Inlet Ctrl Spec: Use dc
Aux XSec1:		Stabilizer Option: None
AuxElev2(ft): 0.000	0.000	
Aux XSec2:		
Top Width(ft):		
Depth(ft):		
Bot Width(ft):		
LtSdSlp(h/v):		
RtSdSlp(h/v):		

Name: B-2 TO B-1	From Node: B-2	Length(ft): 1170.00
Group: DOWN-STREAM-ANA	To Node: TRANS RD	Count: 1

	UPSTREAM	DOWNSTREAM	Friction Equation: Automatic
Geometry: Irregular	Irregular		Solution Algorithm: Automatic
Invert(ft): 120.000	110.000		Flow: Positive
TClpInitZ(ft): 9999.000	9999.000		Contraction Coef: 0.100
Manning's N:			Expansion Coef: 0.300
Top Clip(ft):			Entrance Loss Coef: 0.000
Bot Clip(ft):			Exit Loss Coef: 0.000
Main XSec: B-2	B-1		Outlet Ctrl Spec: Use dc or tw
AuxElev1(ft): 0.000	0.000		Inlet Ctrl Spec: Use dc
Aux XSec1:			Stabilizer Option: None
AuxElev2(ft): 0.000	0.000		
Aux XSec2:			
Top Width(ft):			
Depth(ft):			
Bot Width(ft):			
LtSdSlp(h/v):			
RtSdSlp(h/v):			

Name: B-3 TO B-2	From Node: B-3	Length(ft): 700.00
Group: DOWN-STREAM-ANA	To Node: B-2	Count: 1

	UPSTREAM	DOWNSTREAM	Friction Equation: Automatic
Geometry: Irregular	Irregular		Solution Algorithm: Automatic
Invert(ft): 124.000	120.000		Flow: Both
TClpInitZ(ft): 9999.000	9999.000		Contraction Coef: 0.100
Manning's N:			Expansion Coef: 0.300
Top Clip(ft):			Entrance Loss Coef: 0.000
Bot Clip(ft):			Exit Loss Coef: 0.000
Main XSec: B-3	B-2		Outlet Ctrl Spec: Use dc or tw
AuxElev1(ft): 0.000	0.000		Inlet Ctrl Spec: Use dc
Aux XSec1:			Stabilizer Option: None
AuxElev2(ft): 0.000	0.000		
Aux XSec2:			
Top Width(ft):			
Depth(ft):			
Bot Width(ft):			
LtSdSlp(h/v):			
RtSdSlp(h/v):			

natural channel with stones and weeds

Name: CREEK-C	From Node: RAILROAD-1	Length(ft): 793.00
Group: DOWN-STREAM-ANA	To Node: CONFLUENCE	Count: 1

	UPSTREAM	DOWNSTREAM	Friction Equation: Automatic
Geometry: Irregular	Irregular		Solution Algorithm: Automatic
Invert(ft): 115.000	110.000		Flow: Positive
TClpInitZ(ft): 9999.000	9999.000		Contraction Coef: 0.100
Manning's N:			Expansion Coef: 0.300
Top Clip(ft):			Entrance Loss Coef: 0.000
Bot Clip(ft):			Exit Loss Coef: 0.000
Main XSec: C-2	C-1		Outlet Ctrl Spec: Use dc or tw
AuxElev1(ft): 0.000	0.000		Inlet Ctrl Spec: Use dc
Aux XSec1:			Stabilizer Option: None
AuxElev2(ft): 0.000	0.000		
Aux XSec2:			

DOWNSTREAM ANALYSIS-POST

Top Width(ft):
 Depth(ft):
 Bot Width(ft):
 LtSdSlp(h/v):
 RtSdSlp(h/v):

```

-----
      Name: WEST BRANCH      From Node: CONFLUENCE      Length(ft): 1696.00
      Group: DOWN-STREAM-ANA  To Node: BARINEAU-RD      Count: 1

      UPSTREAM      DOWNSTREAM      Friction Equation: Automatic
      Geometry: Irregular      Irregular      Solution Algorithm: Automatic
      Invert(ft): 104.000      94.000      Flow: Positive
      TClpInitZ(ft): 9999.000      9999.000      Contraction Coef: 0.100
      Manning's N:      Expansion Coef: 0.300
      Top Clip(ft):      Entrance Loss Coef: 0.000
      Bot Clip(ft):      Exit Loss Coef: 0.000
      Main XSec: A-2      A-1      Outlet Ctrl Spec: Use dc or tw
      AuxElev1(ft): 0.000      0.000      Inlet Ctrl Spec: Use dc
      Aux XSec1:      Stabilizer Option: None
      AuxElev2(ft): 0.000      0.000
      Aux XSec2:
      Top Width(ft):
      Depth(ft):
      Bot Width(ft):
      LtSdSlp(h/v):
      RtSdSlp(h/v):
  
```

==== Drop Structures =====

```

      Name: P-DROP TO OUT      From Node: E-SWMF      Length(ft): 26.58
      Group: DOWN-STREAM-ANA  To Node: B-3      Count: 1

      UPSTREAM      DOWNSTREAM      Friction Equation: Automatic
      Geometry: Circular      Circular      Solution Algorithm: Automatic
      Span(in): 12.00      12.00      Flow: Both
      Rise(in): 12.00      12.00      Entrance Loss Coef: 0.000
      Invert(ft): 125.770      125.690      Exit Loss Coef: 1.000
      Manning's N: 0.011000      0.011000      Outlet Ctrl Spec: Use dc or tw
      Top Clip(in): 0.000      0.000      Inlet Ctrl Spec: Use dc
      Bot Clip(in): 0.000      0.000      Solution Incs: 10
  
```

Upstream FHWA Inlet Edge Description:
 Circular: Smooth tapered inlet throat

Downstream FHWA Inlet Edge Description:
 Circular: Smooth tapered inlet throat

*** Weir 1 of 3 for Drop Structure P-DROP TO OUT ***

TABLE

```

      Count: 1      Bottom Clip(in): 0.000
      Type: Horizontal      Top Clip(in): 0.000
      Flow: Both      Weir Disc Coef: 3.200
      Geometry: Rectangular      Orifice Disc Coef: 0.670

      Span(in): 36.00      Invert(ft): 131.310
      Rise(in): 54.00      Control Elev(ft): 131.310
  
```

*** Weir 2 of 3 for Drop Structure P-DROP TO OUT ***

TABLE

```

      Count: 1      Bottom Clip(in): 0.000
      Type: Vertical: Mavis      Top Clip(in): 0.000
      Flow: Both      Weir Disc Coef: 3.200
      Geometry: Circular      Orifice Disc Coef: 0.670

      Span(in): 4.00      Invert(ft): 125.640
      Rise(in): 4.00      Control Elev(ft): 125.640
  
```

*** Weir 3 of 3 for Drop Structure P-DROP TO OUT ***

TABLE

```

      Count: 1      Bottom Clip(in): 0.000
      Type: Vertical: Mavis      Top Clip(in): 0.000
      Flow: Both      Weir Disc Coef: 3.200
      Geometry: Rectangular      Orifice Disc Coef: 0.600
  
```

Span(in): 36.00 Invert(ft): 128.580
Rise(in): 27.80 Control Elev(ft): 128.580

=====

==== Weirs =====

=====

Name: BARINEAU-RD-W From Node: BARINEAU-RD
Group: DOWN-STREAM-ANA To Node: POA-BARINEAU
Flow: Both Count: 1
Type: Vertical: Paved Geometry: Trapezoidal

Bottom Width(ft): 100.00
Left Side Slope(h/v): 0.01
Right Side Slope(h/v): 0.00
Invert(ft): 101.830
Control Elevation(ft): 101.830
Struct Opening Dim(ft): 9999.00

TABLE

Bottom Clip(ft): 0.000
Top Clip(ft): 0.000
Weir Discharge Coef: 3.200
Orifice Discharge Coef: 0.600

Name: BETHEL CHURCH-W From Node: BETHEL-CHURCH-
Group: DOWN-STREAM-ANA To Node: D-3
Flow: Both Count: 1
Type: Vertical: Paved Geometry: Irregular

XSec: BETHEL-CHURCH-R
Invert(ft): 151.310
Control Elevation(ft): 151.310
Struct Opening Dim(ft): 9999.00

TABLE

Bottom Clip(ft): 0.000
Top Clip(ft): 0.000
Weir Discharge Coef: 3.200
Orifice Discharge Coef: 0.600

Name: P-WEIR From Node: E-SWMF
Group: DOWN-STREAM-ANA To Node: B-3
Flow: Both Count: 1
Type: Vertical: Mavis Geometry: Trapezoidal

Bottom Width(ft): 10.00
Left Side Slope(h/v): 5.00
Right Side Slope(h/v): 5.00
Invert(ft): 129.750
Control Elevation(ft): 129.750
Struct Opening Dim(ft): 9999.00

TABLE

Bottom Clip(ft): 0.000
Top Clip(ft): 0.000
Weir Discharge Coef: 3.200
Orifice Discharge Coef: 0.600

Existing Spillway Raised 2 feet

Name: RAIL ROAD-W From Node: D-3
Group: DOWN-STREAM-ANA To Node: RAILROAD-1
Flow: Both Count: 1
Type: Vertical: Fread Geometry: Rectangular

Span(in): 1248.00
Rise(in): 30.00
Invert(ft): 126.650
Control Elevation(ft): 126.650

TABLE

Bottom Clip(in): 0.000
Top Clip(in): 0.000
Weir Discharge Coef: 3.200
Orifice Discharge Coef: 0.600

==== Hydrology Simulations =====

Name: 100yr-1hr
Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\100yr-1hr.R32

Override Defaults: Yes
Storm Duration(hrs): 1.00
Rainfall File: Fdot-1
Rainfall Amount(in): 4.40

Time(hrs)	Print Inc(min)
2.000	2.00

Name: 100yr-24hr
Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\100yr-24hr.R32

Override Defaults: Yes
Storm Duration(hrs): 24.00
Rainfall File: Fdot-24
Rainfall Amount(in): 10.90

Time(hrs)	Print Inc(min)
24.000	2.00

Name: 100yr-2hr
Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\100yr-2hr.R32

Override Defaults: Yes
Storm Duration(hrs): 2.00
Rainfall File: Fdot-2
Rainfall Amount(in): 5.80

Time(hrs)	Print Inc(min)
2.000	2.00

Name: 100yr-4hr
Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\100yr-4hr.R32

Override Defaults: Yes
Storm Duration(hrs): 4.00
Rainfall File: Fdot-4
Rainfall Amount(in): 7.20

Time(hrs)	Print Inc(min)
4.000	2.00

Name: 100yr-8hr
Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\100yr-8hr.R32

Override Defaults: Yes
Storm Duration(hrs): 8.00
Rainfall File: Fdot-8
Rainfall Amount(in): 8.90

Time(hrs)	Print Inc(min)
8.000	2.00

Name: 10yr-1hr
Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\10yr-1hr.R32

Override Defaults: Yes
Storm Duration(hrs): 1.00
Rainfall File: Fdot-1
Rainfall Amount(in): 3.20

Time(hrs)	Print Inc(min)
2.000	2.00

Name: 10yr-24hr

Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\10yr-24hr.R32

Override Defaults: Yes
Storm Duration(hrs): 24.00
Rainfall File: Fdot-24
Rainfall Amount(in): 7.50

Time(hrs)	Print Inc(min)
24.000	2.00

Name: 10yr-2hr
Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\10yr-2hr.R32

Override Defaults: Yes
Storm Duration(hrs): 2.00
Rainfall File: Fdot-2
Rainfall Amount(in): 4.10

Time(hrs)	Print Inc(min)
2.000	2.00

Name: 10yr-4hr
Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\10yr-4hr.R32

Override Defaults: Yes
Storm Duration(hrs): 4.00
Rainfall File: Fdot-4
Rainfall Amount(in): 5.00

Time(hrs)	Print Inc(min)
4.000	2.00

Name: 10yr-8hr
Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\10yr-8hr.R32

Override Defaults: Yes
Storm Duration(hrs): 8.00
Rainfall File: Fdot-8
Rainfall Amount(in): 6.20

Time(hrs)	Print Inc(min)
8.000	2.00

Name: 25YR-1HR
Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\25YR-1HR.R32

Override Defaults: Yes
Storm Duration(hrs): 1.00
Rainfall File: Fdot-1
Rainfall Amount(in): 3.70

Time(hrs)	Print Inc(min)
2.000	2.00

Name: 25YR-24HR
Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\25YR-24HR.R32

Override Defaults: Yes
Storm Duration(hrs): 24.00
Rainfall File: Fdot-24
Rainfall Amount(in): 8.50

Time(hrs)	Print Inc(min)
24.000	2.00

Name: 25YR-2HR
Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\25YR-2HR.R32

Override Defaults: Yes
Storm Duration(hrs): 2.00
Rainfall File: Fdot-2

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Rainfall Amount(in): 4.70

Time(hrs)	Print Inc(min)
2.000	2.00

Name: 25YR-4HR
Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\25YR-4HR.R32

Override Defaults: Yes
Storm Duration(hrs): 4.00
Rainfall File: Fdot-4
Rainfall Amount(in): 5.90

Time(hrs)	Print Inc(min)
4.000	2.00

Name: 25YR-8HR
Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\25YR-8HR.R32

Override Defaults: Yes
Storm Duration(hrs): 8.00
Rainfall File: Fdot-8
Rainfall Amount(in): 7.40

Time(hrs)	Print Inc(min)
8.000	2.00

Name: 2yr-1hr
Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\2yr-1hr.R32

Override Defaults: Yes
Storm Duration(hrs): 1.00
Rainfall File: Fdot-1
Rainfall Amount(in): 2.30

Time(hrs)	Print Inc(min)
2.000	2.00

Name: 2yr-24hr
Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\2yr-24hr.R32

Override Defaults: Yes
Storm Duration(hrs): 24.00
Rainfall File: Fdot-24
Rainfall Amount(in): 4.70

Time(hrs)	Print Inc(min)
24.000	2.00

Name: 2yr-2hr
Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\2yr-2hr.R32

Override Defaults: Yes
Storm Duration(hrs): 2.00
Rainfall File: Fdot-2
Rainfall Amount(in): 3.00

Time(hrs)	Print Inc(min)
2.000	2.00

Name: 2yr-4hr
Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\2yr-4hr.R32

Override Defaults: Yes
Storm Duration(hrs): 4.00
Rainfall File: Fdot-4
Rainfall Amount(in): 3.50

Time(hrs)	Print Inc(min)
4.000	2.00

DOWNSTREAM ANALYSIS-POST

Name: 2yr-8hr
Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\2yr-8hr.R32
Override Defaults: Yes
Storm Duration(hrs): 8.00
Rainfall File: Fdot-8
Rainfall Amount(in): 4.20

Time(hrs)	Print	Inc(min)
8.000		2.00

Name: 50yr-1hr
Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\50yr-1hr.R32
Override Defaults: Yes
Storm Duration(hrs): 1.00
Rainfall File: Fdot-1
Rainfall Amount(in): 4.00

Time(hrs)	Print	Inc(min)
2.000		2.00

Name: 50yr-24hr
Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\50yr-24hr.R32
Override Defaults: Yes
Storm Duration(hrs): 24.00
Rainfall File: Fdot-24
Rainfall Amount(in): 9.60

Time(hrs)	Print	Inc(min)
24.000		2.00

Name: 50yr-2hr
Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\50yr-2hr.R32
Override Defaults: Yes
Storm Duration(hrs): 2.00
Rainfall File: Fdot-2
Rainfall Amount(in): 5.20

Time(hrs)	Print	Inc(min)
2.000		2.00

Name: 50yr-4hr
Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\50yr-4hr.R32
Override Defaults: Yes
Storm Duration(hrs): 4.00
Rainfall File: Fdot-4
Rainfall Amount(in): 6.40

Time(hrs)	Print	Inc(min)
4.000		2.00

Name: 50yr-8hr
Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\50yr-8hr.R32
Override Defaults: Yes
Storm Duration(hrs): 8.00
Rainfall File: Fdot-8
Rainfall Amount(in): 8.00

Time(hrs)	Print	Inc(min)
8.000		2.00

Name: 5yr-1hr
Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\5yr-1hr.R32

Override Defaults: Yes
 Storm Duration(hrs): 1.00
 Rainfall File: Fdot-1
 Rainfall Amount(in): 2.80

Time(hrs)	Print Inc(min)
2.000	2.00

Name: 5yr-24hr
 Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\5yr-24hr.R32

Override Defaults: Yes
 Storm Duration(hrs): 24.00
 Rainfall File: Fdot-24
 Rainfall Amount(in): 6.40

Time(hrs)	Print Inc(min)
24.000	2.00

Name: 5yr-2hr
 Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\5yr-2hr.R32

Override Defaults: Yes
 Storm Duration(hrs): 2.00
 Rainfall File: Fdot-2
 Rainfall Amount(in): 3.60

Time(hrs)	Print Inc(min)
2.000	2.00

Name: 5yr-4hr
 Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\5yr-4hr.R32

Override Defaults: Yes
 Storm Duration(hrs): 4.00
 Rainfall File: Fdot-4
 Rainfall Amount(in): 4.40

Time(hrs)	Print Inc(min)
4.000	2.00

Name: 5yr-8hr
 Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\5yr-8hr.R32

Override Defaults: Yes
 Storm Duration(hrs): 8.00
 Rainfall File: Fdot-8
 Rainfall Amount(in): 5.50

Time(hrs)	Print Inc(min)
8.000	2.00

==== Routing Simulations =====

Name: 100yr-1hr Hydrology Sim: 100yr-1hr
 Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\100yr-1hr.I32

Execute: Yes Restart: No Patch: No
 Alternative: No

Max Delta Z(ft): 1.00	Delta Z Factor: 0.00500
Time Step Optimizer: 10.000	
Start Time(hrs): 0.000	End Time(hrs): 2.00
Min Calc Time(sec): 0.5000	Max Calc Time(sec): 60.0000
Boundary Stages:	Boundary Flows:

Time(hrs)	Print Inc(min)
2.000	2.000

Group	Run
-----	-----
DOWN-STREAM-ANA	Yes

Name: 100yr-24hr Hydrology Sim: 100yr-24hr
 Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\100yr-24hr.I32

Execute: Yes	Restart: No	Patch: No
Alternative: No		
Max Delta Z(ft): 1.00	Delta Z Factor: 0.00500	
Time Step Optimizer: 10.000		
Start Time(hrs): 0.000	End Time(hrs): 24.00	
Min Calc Time(sec): 0.5000	Max Calc Time(sec): 60.0000	
Boundary Stages:	Boundary Flows:	

Time(hrs)	Print Inc(min)
-----	-----
24.000	2.000

Group	Run
-----	-----
DOWN-STREAM-ANA	Yes

Name: 100yr-2hr Hydrology Sim: 100yr-2hr
 Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\100yr-2hr.I32

Execute: Yes	Restart: No	Patch: No
Alternative: No		
Max Delta Z(ft): 1.00	Delta Z Factor: 0.00500	
Time Step Optimizer: 10.000		
Start Time(hrs): 0.000	End Time(hrs): 2.00	
Min Calc Time(sec): 0.5000	Max Calc Time(sec): 60.0000	
Boundary Stages:	Boundary Flows:	

Time(hrs)	Print Inc(min)
-----	-----
2.000	2.000

Group	Run
-----	-----
DOWN-STREAM-ANA	Yes

Name: 100yr-4hr Hydrology Sim: 100yr-4hr
 Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\100yr-4hr.I32

Execute: Yes	Restart: No	Patch: No
Alternative: No		
Max Delta Z(ft): 1.00	Delta Z Factor: 0.00500	
Time Step Optimizer: 10.000		
Start Time(hrs): 0.000	End Time(hrs): 4.00	
Min Calc Time(sec): 0.5000	Max Calc Time(sec): 60.0000	
Boundary Stages:	Boundary Flows:	

Time(hrs)	Print Inc(min)
-----	-----
4.000	2.000

Group	Run
-----	-----
DOWN-STREAM-ANA	Yes

Name: 100yr-8hr Hydrology Sim: 100yr-8hr
 Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\100yr-8hr.I32

Execute: Yes	Restart: No	Patch: No
Alternative: No		

DOWNSTREAM ANALYSIS-POST

Max Delta Z(ft): 1.00	Delta Z Factor: 0.00500
Time Step Optimizer: 10.000	
Start Time(hrs): 0.000	End Time(hrs): 8.00
Min Calc Time(sec): 0.5000	Max Calc Time(sec): 60.0000
Boundary Stages:	Boundary Flows:

Time(hrs)	Print Inc(min)
-----	-----
8.000	2.000

Group	Run
-----	-----
DOWN-STREAM-ANA	Yes

Name: 10yr-1hr	Hydrology Sim: 10YR-1HR
Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\10yr-1hr.I32	

Execute: Yes	Restart: No	Patch: No
Alternative: No		

Max Delta Z(ft): 1.00	Delta Z Factor: 0.00500
Time Step Optimizer: 10.000	
Start Time(hrs): 0.000	End Time(hrs): 2.00
Min Calc Time(sec): 0.5000	Max Calc Time(sec): 60.0000
Boundary Stages:	Boundary Flows:

Time(hrs)	Print Inc(min)
-----	-----
2.000	2.000

Group	Run
-----	-----
DOWN-STREAM-ANA	Yes

Name: 10yr-24hr	Hydrology Sim: 10YR-24HR
Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\10yr-24hr.I32	

Execute: Yes	Restart: No	Patch: No
Alternative: No		

Max Delta Z(ft): 1.00	Delta Z Factor: 0.00500
Time Step Optimizer: 10.000	
Start Time(hrs): 0.000	End Time(hrs): 24.00
Min Calc Time(sec): 0.5000	Max Calc Time(sec): 60.0000
Boundary Stages:	Boundary Flows:

Time(hrs)	Print Inc(min)
-----	-----
24.000	2.000

Group	Run
-----	-----
DOWN-STREAM-ANA	Yes

Name: 10yr-2hr	Hydrology Sim: 10YR-2HR
Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\10yr-2hr.I32	

Execute: Yes	Restart: No	Patch: No
Alternative: No		

Max Delta Z(ft): 1.00	Delta Z Factor: 0.00500
Time Step Optimizer: 10.000	
Start Time(hrs): 0.000	End Time(hrs): 2.00
Min Calc Time(sec): 0.5000	Max Calc Time(sec): 60.0000
Boundary Stages:	Boundary Flows:

Time(hrs)	Print Inc(min)
-----	-----

DOWNSTREAM ANALYSIS-POST

2.000 2.000
Group Run

DOWN-STREAM-ANA Yes

Name: 10yr-4hr Hydrology Sim: 10YR-4HR
Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\10yr-4hr.I32

Execute: Yes Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000 End Time(hrs): 4.00
Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
Boundary Stages: Boundary Flows:

Time(hrs) Print Inc(min)

4.000 2.000
Group Run

DOWN-STREAM-ANA Yes

Name: 10yr-8hr Hydrology Sim: 10YR-8HR
Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\10yr-8hr.I32

Execute: Yes Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000 End Time(hrs): 8.00
Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
Boundary Stages: Boundary Flows:

Time(hrs) Print Inc(min)

8.000 2.000
Group Run

DOWN-STREAM-ANA Yes

Name: 25yr-1hr Hydrology Sim: 25YR-1HR
Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\25yr-1hr.I32

Execute: Yes Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000 End Time(hrs): 2.00
Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
Boundary Stages: Boundary Flows:

Time(hrs) Print Inc(min)

2.000 2.000
Group Run

DOWN-STREAM-ANA Yes

Name: 25yr-24hr Hydrology Sim: 25YR-24HR
Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\25yr-24hr.I32

DOWNSTREAM ANALYSIS-POST

Execute: Yes	Restart: No	Patch: No
Alternative: No		
Max Delta Z(ft): 1.00	Delta Z Factor: 0.00500	
Time Step Optimizer: 10.000		
Start Time(hrs): 0.000	End Time(hrs): 24.00	
Min Calc Time(sec): 0.5000	Max	Calc Time(sec): 60.0000
Boundary Stages:	Boundary Flows:	

Time(hrs)	Print Inc(min)
-----	-----
24.000	2.000

Group	Run
-----	-----
DOWN-STREAM-ANA Yes	

Name: 25yr-2hr	Hydrology Sim: 25YR-2HR
Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\25yr-2hr.I32	

Execute: Yes	Restart: No	Patch: No
Alternative: No		
Max Delta Z(ft): 1.00	Delta Z Factor: 0.00500	
Time Step Optimizer: 10.000		
Start Time(hrs): 0.000	End Time(hrs): 2.00	
Min Calc Time(sec): 0.5000	Max	Calc Time(sec): 60.0000
Boundary Stages:	Boundary Flows:	

Time(hrs)	Print Inc(min)
-----	-----
2.000	2.000

Group	Run
-----	-----
DOWN-STREAM-ANA Yes	

Name: 25yr-4hr	Hydrology Sim: 25YR-4HR
Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\25yr-4hr.I32	

Execute: Yes	Restart: No	Patch: No
Alternative: No		
Max Delta Z(ft): 1.00	Delta Z Factor: 0.00500	
Time Step Optimizer: 10.000		
Start Time(hrs): 0.000	End Time(hrs): 4.00	
Min Calc Time(sec): 0.5000	Max	Calc Time(sec): 60.0000
Boundary Stages:	Boundary Flows:	

Time(hrs)	Print Inc(min)
-----	-----
4.000	2.000

Group	Run
-----	-----
DOWN-STREAM-ANA Yes	

Name: 25yr-8hr	Hydrology Sim: 25YR-8HR
Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\25yr-8hr.I32	

Execute: Yes	Restart: No	Patch: No
Alternative: No		
Max Delta Z(ft): 1.00	Delta Z Factor: 0.00500	
Time Step Optimizer: 10.000		
Start Time(hrs): 0.000	End Time(hrs): 8.00	
Min Calc Time(sec): 0.5000	Max	Calc Time(sec): 60.0000
Boundary Stages:	Boundary Flows:	

Time(hrs)	Print Inc(min)
8.000	2.000

Group	Run
DOWN-STREAM-ANA	Yes

Name: 2yr-1hr Hydrology Sim: 2YR-1HR
 Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\2yr-1hr.I32

Execute: Yes Restart: No Patch: No
 Alternative: No

Max Delta Z(ft): 1.00	Delta Z Factor: 0.00500
Time Step Optimizer: 10.000	
Start Time(hrs): 0.000	End Time(hrs): 2.00
Min Calc Time(sec): 0.5000	Max Calc Time(sec): 60.0000
Boundary Stages:	Boundary Flows:

Time(hrs)	Print Inc(min)
2.000	2.000

Group	Run
DOWN-STREAM-ANA	Yes

Name: 2yr-24hr Hydrology Sim: 2YR-24HR
 Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\2yr-24hr.I32

Execute: Yes Restart: No Patch: No
 Alternative: No

Max Delta Z(ft): 1.00	Delta Z Factor: 0.00500
Time Step Optimizer: 10.000	
Start Time(hrs): 0.000	End Time(hrs): 24.00
Min Calc Time(sec): 0.5000	Max Calc Time(sec): 60.0000
Boundary Stages:	Boundary Flows:

Time(hrs)	Print Inc(min)
24.000	2.000

Group	Run
DOWN-STREAM-ANA	Yes

Name: 2yr-2hr Hydrology Sim: 2YR-2HR
 Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\2yr-2hr.I32

Execute: Yes Restart: No Patch: No
 Alternative: No

Max Delta Z(ft): 1.00	Delta Z Factor: 0.00500
Time Step Optimizer: 10.000	
Start Time(hrs): 0.000	End Time(hrs): 2.00
Min Calc Time(sec): 0.5000	Max Calc Time(sec): 60.0000
Boundary Stages:	Boundary Flows:

Time(hrs)	Print Inc(min)
2.000	2.000

Group	Run
DOWN-STREAM-ANA	Yes

Name: 2yr-4hr Hydrology Sim: 2YR-4HR

Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\2yr-4hr.I32

Execute: Yes Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000 End Time(hrs): 4.00
Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
Boundary Stages: Boundary Flows:

Time(hrs) Print Inc(min)

4.000 2.000

Group Run

DOWN-STREAM-ANA Yes

Name: 2yr-8hr Hydrology Sim: 2YR-8HR
Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\2yr-8hr.I32

Execute: Yes Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000 End Time(hrs): 8.00
Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
Boundary Stages: Boundary Flows:

Time(hrs) Print Inc(min)

8.000 2.000

Group Run

DOWN-STREAM-ANA Yes

Name: 50yr-1hr Hydrology Sim: 50YR-1HR
Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\50yr-1hr.I32

Execute: Yes Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000 End Time(hrs): 2.00
Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
Boundary Stages: Boundary Flows:

Time(hrs) Print Inc(min)

2.000 2.000

Group Run

DOWN-STREAM-ANA Yes

Name: 50yr-24hr Hydrology Sim: 50YR-24HR
Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\50yr-24hr.I32

Execute: Yes Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000 End Time(hrs): 24.00
Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
Boundary Stages: Boundary Flows:

DOWNSTREAM ANALYSIS-POST

Time(hrs)	Print Inc(min)
24.000	2.000

Group	Run
DOWN-STREAM-ANA	Yes

Name: 50yr-2hr	Hydrology Sim: 50YR-2HR
Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\50yr-2hr.I32	
Execute: Yes	Restart: No
Alternative: No	Patch: No
Max Delta Z(ft): 1.00	Delta Z Factor: 0.00500
Time Step Optimizer: 10.000	
Start Time(hrs): 0.000	End Time(hrs): 2.00
Min Calc Time(sec): 0.5000	Max Calc Time(sec): 60.0000
Boundary Stages:	Boundary Flows:

Time(hrs)	Print Inc(min)
2.000	2.000

Group	Run
DOWN-STREAM-ANA	Yes

Name: 50yr-4hr	Hydrology Sim: 50YR-4HR
Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\50yr-4hr.I32	
Execute: Yes	Restart: No
Alternative: No	Patch: No
Max Delta Z(ft): 1.00	Delta Z Factor: 0.00500
Time Step Optimizer: 10.000	
Start Time(hrs): 0.000	End Time(hrs): 4.00
Min Calc Time(sec): 0.5000	Max Calc Time(sec): 60.0000
Boundary Stages:	Boundary Flows:

Time(hrs)	Print Inc(min)
4.000	2.000

Group	Run
DOWN-STREAM-ANA	Yes

Name: 50yr-8hr	Hydrology Sim: 50YR-8HR
Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\50yr-8hr.I32	
Execute: Yes	Restart: No
Alternative: No	Patch: No
Max Delta Z(ft): 1.00	Delta Z Factor: 0.00500
Time Step Optimizer: 10.000	
Start Time(hrs): 0.000	End Time(hrs): 8.00
Min Calc Time(sec): 0.5000	Max Calc Time(sec): 60.0000
Boundary Stages:	Boundary Flows:

Time(hrs)	Print Inc(min)
8.000	2.000

Group	Run
DOWN-STREAM-ANA	Yes

```

-----
Name: 5yr-1hr          Hydrology Sim: 5YR-1HR
Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\5yr-1hr.I32

Execute: Yes          Restart: No          Patch: No
Alternative: No

Max Delta Z(ft): 1.00          Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000          End Time(hrs): 2.00
Min Calc Time(sec): 0.5000      Max Calc Time(sec): 60.0000
Boundary Stages:              Boundary Flows:

Time(hrs)      Print Inc(min)
-----
2.000          2.000

Group          Run
-----
DOWN-STREAM-ANA Yes
  
```

```

-----
Name: 5yr-24hr         Hydrology Sim: 5YR-24HR
Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\5yr-24hr.I32

Execute: Yes          Restart: No          Patch: No
Alternative: No

Max Delta Z(ft): 1.00          Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000          End Time(hrs): 24.00
Min Calc Time(sec): 0.5000      Max Calc Time(sec): 60.0000
Boundary Stages:              Boundary Flows:

Time(hrs)      Print Inc(min)
-----
24.000         2.000

Group          Run
-----
DOWN-STREAM-ANA Yes
  
```

```

-----
Name: 5yr-2hr          Hydrology Sim: 5YR-2HR
Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\5yr-2hr.I32

Execute: Yes          Restart: No          Patch: No
Alternative: No

Max Delta Z(ft): 1.00          Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000          End Time(hrs): 2.00
Min Calc Time(sec): 0.5000      Max Calc Time(sec): 60.0000
Boundary Stages:              Boundary Flows:

Time(hrs)      Print Inc(min)
-----
2.000          2.000

Group          Run
-----
DOWN-STREAM-ANA Yes
  
```

```

-----
Name: 5yr-4hr          Hydrology Sim: 5YR-4HR
Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\5yr-4hr.I32

Execute: Yes          Restart: No          Patch: No
Alternative: No

Max Delta Z(ft): 1.00          Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000          End Time(hrs): 4.00
Min Calc Time(sec): 0.5000      Max Calc Time(sec): 60.0000
  
```

DOWNSTREAM ANALYSIS-POST

Boundary Stages:

Boundary Flows:

Time(hrs) Print Inc(min)

 4.000 2.000

 Group Run

 DOWN-STREAM-ANA Yes

 Name: 5yr-8hr Hydrology Sim: 5YR-8HR
 Filename: C:\Projects\R83.003\Workfiles\STORMWATER\icpr\5yr-8hr.I32

Execute: Yes Restart: No Patch: No
 Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
 Time Step Optimizer: 10.000
 Start Time(hrs): 0.000 End Time(hrs): 8.00
 Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
 Boundary Stages: Boundary Flows:

Time(hrs) Print Inc(min)

 8.000 2.000

 Group Run

 DOWN-STREAM-ANA Yes

=====
 === Boundary Conditions ===
 =====

Name: Node: E-South Type: Stage

Time(hrs) Stage(ft)

 0.000 85.000
 900.000 85.000

5. ICPR Model Results Summary



Project Name: HOPKINS ELECTRIC PLANT

Project No.: R83.001

Prepared By: JMoore

Revised By: LH

Checked By: _____

Date: 3/28/2017

Rev.: 12/14/2018

Date: _____

ICPR RESULTS SUMMARY

ONSITE Pre - Post Development Comparison

ON-SITE POND			
EXISTING			PROPOSED
TOP OF BERM =	131.00		TOP OF BERM = 131.31
TOP OF BAFFLE =	128.58		TOP OF BAFFLE = 129.00
SPILLWAY =	127.73		SPILLWAY = 129.82

BARINEAU ROAD BOX CULVERT	
LOW IN ROAD AT CENTERLINE = 101.83	
BOX CULVERT WIDTH = 7.7'	BOX CULVERT HEIGHT = 4'
CROWN OF BOX CULVERT = 97.64	
INVERT OF BOX CULVERT = 93.64	

Storm Simulation	West - Present Max. Flow (cfs)	East-Pre-dev Max. Flow (cfs)	Allowable Discharge Max. Flow (cfs)	P-SWMF Total Post Max. Flow (cfs)	P-SWMF Max. Stage (feet)	Freeboard (feet)	Pre vs. Post Difference (cfs)	Is Total Post <= Total Pre?
2yr-1hr	15.16	0	15.16	0.59	127.82	3.49	14.570	Yes
2yr-24hr	2.02	0.09	2.02	0.92	128.66	2.65	1.100	Yes
2yr-2hr	14.1	0.05	14.10	0.68	128.35	2.96	13.420	Yes
2yr-4hr	7.21	0.13	7.27	1.02	128.68	2.63	6.250	Yes
2yr-8hr	7.74	0.18	7.76	1.70	128.8	2.51	6.060	Yes
5yr-1hr	20.04	0.03	20.02	0.66	128.27	3.04	19.360	Yes
5yr-24hr	2.9	0.22	3.03	2.40	128.9	2.41	0.630	Yes
5yr-2hr	17.93	0.17	17.89	1.72	128.81	2.50	16.170	Yes
5yr-4hr	9.66	0.41	9.66	4.21	129.1	2.21	5.450	Yes
5yr-8hr	10.58	0.48	10.88	5.28	129.2	2.11	5.600	Yes
10yr-1hr	24	0.13	24.00	0.75	128.61	2.70	23.250	Yes
10yr-24hr	3.47	0.33	3.74	3.14	128.99	2.32	0.600	Yes
10yr-2hr	21.13	0.31	21.14	3.56	129.03	2.28	17.580	Yes
10yr-4hr	11.29	0.64	11.30	6.58	129.32	1.99	4.720	Yes
10yr-8hr	12.1	0.71	12.64	6.82	129.35	1.96	5.820	Yes
25yr-1hr	28.96	0.35	28.94	2.88	128.96	2.35	26.060	Yes
25yr-24hr	3.99	0.43	4.46	4.09	129.09	2.22	0.370	Yes
25yr-2hr	24.96	0.52	25.00	5.77	129.25	2.06	19.230	Yes
25yr-4hr	13.74	1.04	13.84	8.10	129.66	1.65	5.740	Yes
25yr-8hr	14.68	1.26	15.74	8.30	129.76	1.55	7.440	Yes
50yr-1hr	31.94	0.52	31.93	4.65	129.14	2.17	27.280	Yes
50yr-24hr	4.55	0.58	5.16	5.40	129.21	2.10	(0.240)	No
50yr-2hr	28.14	0.74	28.22	7.30	129.43	1.88	20.920	Yes
50yr-4hr	15.09	1.29	15.28	9.66	129.86	1.45	5.620	Yes
50yr-8hr	15.97	1.57	17.32	11.13	129.93	1.38	6.190	Yes
100yr-1hr	35.91	0.79	35.97	7.08	129.38	1.93	28.890	Yes
100yr-24hr	5.21	0.79	5.99	6.66	129.33	1.98	(0.670)	No
100yr-2hr	31.95	1.08	32.15	8.19	129.71	1.60	23.960	Yes
100yr-4hr	17.24	1.72	17.65	13.72	130.02	1.29	3.930	Yes
100yr-8hr	17.9	2.07	19.72	17.30	130.12	1.19	2.420	Yes

BARINEAU RD E-Max. Stage (feet)	BARINEAU RD P-Max. Stage (feet)
94.38	93.77
94.32	94.35
94.43	93.76
94.41	93.87
94.44	94.25
94.52	93.78
95.05	95.08
94.57	93.79
94.57	94.39
94.98	95.05
94.64	93.8
95.49	95.52
94.69	93.97
94.9	94.91
95.41	95.51
94.77	94.06
95.87	95.89
94.81	94.37
95.68	95.74
96.34	96.42
94.85	94.26
96.2	96.22
95.04	94.74
96.19	96.21
96.71	96.78
94.97	94.53
96.63	96.67
95.58	95.26
96.84	96.9
97.24	97.31

P-SWMF	Storm	Max. Stage	Min. Freeboard
	100yr-8hr	130.12	1.19
	Storm	Max. Flow (cfs)	Highwater
	100yr-8hr	17.30	130.12
	25yr-8hr	8.30	129.76

BARINEAU RD		
	Storm	Highwater
PRE	100yr-8hr	97.24
	25yr-8hr	96.34
POST	100yr-8hr	97.31
	25yr-8hr	96.42

6. ICPR Model Results

West-Basin (Present) and East-Basin (Pre-Development) Output

Name	Simulation	Max Stage ft	Warning Stage ft	Max Delta Stage ft	Max Surf Area ft2	Max Inflow cfs	Max Outflow cfs
E-EAST-PRE	100yr-1hr	134.00	136.00	0.0000	0	0.79	0.00
E-EAST-PRE	100yr-24hr	134.00	136.00	0.0000	0	0.79	0.00
E-EAST-PRE	100yr-2hr	134.00	136.00	0.0000	0	1.08	0.00
E-EAST-PRE	100yr-4hr	134.00	136.00	0.0000	0	1.72	0.00
E-EAST-PRE	100yr-8hr	134.00	136.00	0.0000	0	2.07	0.00
E-EAST-PRE	10yr-1hr	134.00	136.00	0.0000	0	0.13	0.00
E-EAST-PRE	10yr-24hr	134.00	136.00	0.0000	0	0.33	0.00
E-EAST-PRE	10yr-2hr	134.00	136.00	0.0000	0	0.31	0.00
E-EAST-PRE	10yr-4hr	134.00	136.00	0.0000	0	0.64	0.00
E-EAST-PRE	10yr-8hr	134.00	136.00	0.0000	0	0.71	0.00
E-EAST-PRE	25yr-1hr	134.00	136.00	0.0000	0	0.35	0.00
E-EAST-PRE	25yr-24hr	134.00	136.00	0.0000	0	0.43	0.00
E-EAST-PRE	25yr-2hr	134.00	136.00	0.0000	0	0.52	0.00
E-EAST-PRE	25yr-4hr	134.00	136.00	0.0000	0	1.04	0.00
E-EAST-PRE	25yr-8hr	134.00	136.00	0.0000	0	1.26	0.00
E-EAST-PRE	2yr-1hr	134.00	136.00	0.0000	0	0.00	0.00
E-EAST-PRE	2yr-24hr	134.00	136.00	0.0000	0	0.09	0.00
E-EAST-PRE	2yr-2hr	134.00	136.00	0.0000	0	0.05	0.00
E-EAST-PRE	2yr-4hr	134.00	136.00	0.0000	0	0.13	0.00
E-EAST-PRE	2yr-8hr	134.00	136.00	0.0000	0	0.18	0.00
E-EAST-PRE	50yr-1hr	134.00	136.00	0.0000	0	0.52	0.00
E-EAST-PRE	50yr-24hr	134.00	136.00	0.0000	0	0.58	0.00
E-EAST-PRE	50yr-2hr	134.00	136.00	0.0000	0	0.74	0.00
E-EAST-PRE	50yr-4hr	134.00	136.00	0.0000	0	1.29	0.00
E-EAST-PRE	50yr-8hr	134.00	136.00	0.0000	0	1.57	0.00
E-EAST-PRE	5yr-1hr	134.00	136.00	0.0000	0	0.03	0.00
E-EAST-PRE	5yr-24hr	134.00	136.00	0.0000	0	0.22	0.00
E-EAST-PRE	5yr-2hr	134.00	136.00	0.0000	0	0.17	0.00
E-EAST-PRE	5yr-4hr	134.00	136.00	0.0000	0	0.41	0.00
E-EAST-PRE	5yr-8hr	134.00	136.00	0.0000	0	0.48	0.00
E-WEST-NOW	100yr-1hr	134.00	136.00	0.0000	0	35.91	0.00
E-WEST-NOW	100yr-24hr	134.00	136.00	0.0000	0	5.21	0.00
E-WEST-NOW	100yr-2hr	134.00	136.00	0.0000	0	31.95	0.00
E-WEST-NOW	100yr-4hr	134.00	136.00	0.0000	0	17.24	0.00
E-WEST-NOW	100yr-8hr	134.00	136.00	0.0000	0	17.90	0.00
E-WEST-NOW	10yr-1hr	134.00	136.00	0.0000	0	24.00	0.00
E-WEST-NOW	10yr-24hr	134.00	136.00	0.0000	0	3.47	0.00
E-WEST-NOW	10yr-2hr	134.00	136.00	0.0000	0	21.13	0.00
E-WEST-NOW	10yr-4hr	134.00	136.00	0.0000	0	11.29	0.00
E-WEST-NOW	10yr-8hr	134.00	136.00	0.0000	0	12.10	0.00
E-WEST-NOW	25yr-1hr	134.00	136.00	0.0000	0	28.96	0.00
E-WEST-NOW	25yr-24hr	134.00	136.00	0.0000	0	3.99	0.00
E-WEST-NOW	25yr-2hr	134.00	136.00	0.0000	0	24.96	0.00
E-WEST-NOW	25yr-4hr	134.00	136.00	0.0000	0	13.74	0.00
E-WEST-NOW	25yr-8hr	134.00	136.00	0.0000	0	14.68	0.00
E-WEST-NOW	2yr-1hr	134.00	136.00	0.0000	0	15.16	0.00
E-WEST-NOW	2yr-24hr	134.00	136.00	0.0000	0	2.02	0.00
E-WEST-NOW	2yr-2hr	134.00	136.00	0.0000	0	14.10	0.00
E-WEST-NOW	2yr-4hr	134.00	136.00	0.0000	0	7.21	0.00
E-WEST-NOW	2yr-8hr	134.00	136.00	0.0000	0	7.74	0.00
E-WEST-NOW	50yr-1hr	134.00	136.00	0.0000	0	31.94	0.00
E-WEST-NOW	50yr-24hr	134.00	136.00	0.0000	0	4.55	0.00
E-WEST-NOW	50yr-2hr	134.00	136.00	0.0000	0	28.14	0.00
E-WEST-NOW	50yr-4hr	134.00	136.00	0.0000	0	15.09	0.00
E-WEST-NOW	50yr-8hr	134.00	136.00	0.0000	0	15.97	0.00
E-WEST-NOW	5yr-1hr	134.00	136.00	0.0000	0	20.04	0.00
E-WEST-NOW	5yr-24hr	134.00	136.00	0.0000	0	2.90	0.00
E-WEST-NOW	5yr-2hr	134.00	136.00	0.0000	0	17.93	0.00
E-WEST-NOW	5yr-4hr	134.00	136.00	0.0000	0	9.66	0.00
E-WEST-NOW	5yr-8hr	134.00	136.00	0.0000	0	10.58	0.00

Downstream Analysis Pre-Development Output

Name	Group	Simulation	Max Time Stage hrs	Max Stage ft	Warning Stage ft	Max Delta Stage ft	Max Surf Area ft2	Max Time Inflow hrs	Max Inflow cfs	Max Time Outflow hrs	Max Outflow cfs
B-2DOWN-STREAM-ANA		100yr-1hr	0.79	120.51	123.00	0.0020	55114	0.61	35.70	0.79	23.02
B-2DOWN-STREAM-ANA		100yr-24hr	15.27	120.44	123.00	-0.0004	52824	15.05	18.12	15.27	17.88
B-2DOWN-STREAM-ANA		100yr-2hr	0.93	120.50	123.00	0.0014	54906	0.82	31.44	0.93	22.41
B-2DOWN-STREAM-ANA		100yr-4hr	3.21	120.56	123.00	0.0007	55540	3.04	28.63	3.21	26.24
B-2DOWN-STREAM-ANA		100yr-8hr	5.11	120.63	123.00	0.0007	57078	5.03	32.78	5.11	31.69
B-2DOWN-STREAM-ANA		10yr-1hr	0.83	120.37	123.00	0.0015	51819	0.62	23.56	0.83	13.94
B-2DOWN-STREAM-ANA		10yr-24hr	19.14	120.23	123.00	-0.0003	48370	19.03	6.70	19.14	6.58
B-2DOWN-STREAM-ANA		10yr-2hr	0.96	120.36	123.00	0.0011	51541	0.82	20.52	0.96	13.24
B-2DOWN-STREAM-ANA		10yr-4hr	2.55	120.30	123.00	0.0007	50075	2.02	11.21	2.55	9.77
B-2DOWN-STREAM-ANA		10yr-8hr	4.06	120.33	123.00	0.0006	50902	4.01	12.58	4.06	11.69
B-2DOWN-STREAM-ANA		25yr-1hr	0.81	120.43	123.00	0.0019	53220	0.62	28.58	0.81	17.62
B-2DOWN-STREAM-ANA		25yr-24hr	19.12	120.28	123.00	-0.0003	49530	19.04	9.28	19.12	9.17
B-2DOWN-STREAM-ANA		25yr-2hr	0.95	120.41	123.00	0.0012	52764	0.82	24.35	0.95	16.39
B-2DOWN-STREAM-ANA		25yr-4hr	3.12	120.35	123.00	0.0006	51079	3.04	13.78	3.12	12.61
B-2DOWN-STREAM-ANA		25yr-8hr	5.14	120.42	123.00	0.0006	52596	5.03	18.19	5.14	17.04
B-2DOWN-STREAM-ANA		2yr-1hr	0.86	120.26	123.00	-0.0019	49171	0.64	14.71	0.86	7.81
B-2DOWN-STREAM-ANA		2yr-24hr	12.09	120.10	123.00	-0.0001	45768	12.00	2.01	12.09	1.91
B-2DOWN-STREAM-ANA		2yr-2hr	1.02	120.26	123.00	0.0010	49186	0.83	13.57	1.02	7.85
B-2DOWN-STREAM-ANA		2yr-4hr	2.57	120.22	123.00	0.0005	48308	2.03	7.11	2.57	6.08
B-2DOWN-STREAM-ANA		2yr-8hr	4.07	120.24	123.00	0.0005	48748	4.01	7.71	4.07	6.95
B-2DOWN-STREAM-ANA		50yr-1hr	0.80	120.47	123.00	0.0017	54041	0.61	31.62	0.80	19.90
B-2DOWN-STREAM-ANA		50yr-24hr	15.38	120.35	123.00	-0.0003	51013	15.05	13.02	15.38	12.81
B-2DOWN-STREAM-ANA		50yr-2hr	0.94	120.45	123.00	0.0013	53754	0.82	27.56	0.94	19.09
B-2DOWN-STREAM-ANA		50yr-4hr	3.18	120.42	123.00	0.0007	52645	3.04	18.82	3.18	17.04
B-2DOWN-STREAM-ANA		50yr-8hr	5.13	120.50	123.00	0.0007	54371	5.03	23.63	5.13	22.46
B-2DOWN-STREAM-ANA		5yr-1hr	0.84	120.32	123.00	-0.0020	50664	0.63	19.59	0.84	11.13
B-2DOWN-STREAM-ANA		5yr-24hr	19.17	120.17	123.00	-0.0002	47048	19.03	4.13	19.17	4.01
B-2DOWN-STREAM-ANA		5yr-2hr	0.99	120.31	123.00	0.0010	50488	0.83	17.35	0.99	10.72
B-2DOWN-STREAM-ANA		5yr-4hr	2.56	120.26	123.00	0.0006	49386	2.02	9.57	2.56	8.27
B-2DOWN-STREAM-ANA		5yr-8hr	4.06	120.30	123.00	0.0006	50167	4.00	10.80	4.06	9.98
B-3DOWN-STREAM-ANA		100yr-1hr	0.61	124.09	126.00	0.0006	67173	0.60	35.97	0.61	35.70
B-3DOWN-STREAM-ANA		100yr-24hr	12.00	124.03	126.00	-0.0001	66031	12.00	5.99	12.00	5.97
B-3DOWN-STREAM-ANA		100yr-2hr	0.82	124.08	126.00	0.0004	67034	0.80	32.15	0.82	31.44
B-3DOWN-STREAM-ANA		100yr-4hr	2.02	124.05	126.00	0.0002	66540	2.00	17.65	2.02	17.53
B-3DOWN-STREAM-ANA		100yr-8hr	4.00	124.06	126.00	0.0002	66619	4.00	19.72	4.00	19.60
B-3DOWN-STREAM-ANA		10yr-1hr	0.62	124.07	126.00	0.0005	66764	0.60	24.00	0.62	23.56
B-3DOWN-STREAM-ANA		10yr-24hr	12.01	124.02	126.00	0.0000	65905	11.99	3.74	12.01	3.73
B-3DOWN-STREAM-ANA		10yr-2hr	0.82	124.06	126.00	0.0003	66653	0.80	21.14	0.82	20.52
B-3DOWN-STREAM-ANA		10yr-4hr	2.02	124.04	126.00	0.0001	66281	2.00	11.30	2.02	11.21
B-3DOWN-STREAM-ANA		10yr-8hr	4.00	124.04	126.00	0.0002	66338	4.00	12.64	4.00	12.55
B-3DOWN-STREAM-ANA		25yr-1hr	0.62	124.07	126.00	0.0006	66939	0.60	28.94	0.62	28.58
B-3DOWN-STREAM-ANA		25yr-24hr	12.00	124.02	126.00	0.0001	65943	12.05	4.46	12.00	4.37
B-3DOWN-STREAM-ANA		25yr-2hr	0.82	124.07	126.00	0.0004	66792	0.80	25.00	0.82	24.35
B-3DOWN-STREAM-ANA		25yr-4hr	2.02	124.05	126.00	0.0002	66388	2.00	13.84	2.02	13.74
B-3DOWN-STREAM-ANA		25yr-8hr	4.00	124.05	126.00	0.0002	66465	4.00	15.74	4.00	15.63
B-3DOWN-STREAM-ANA		2yr-1hr	0.64	124.05	126.00	0.0004	66428	0.60	15.16	0.64	14.71
B-3DOWN-STREAM-ANA		2yr-24hr	12.00	124.01	126.00	0.0003	65793	12.00	2.02	12.00	2.01
B-3DOWN-STREAM-ANA		2yr-2hr	0.83	124.05	126.00	0.0003	66381	0.80	14.10	0.83	13.57
B-3DOWN-STREAM-ANA		2yr-4hr	2.03	124.03	126.00	0.0001	66090	2.04	7.27	2.03	7.11
B-3DOWN-STREAM-ANA		2yr-8hr	4.01	124.03	126.00	0.0002	66119	4.00	7.76	4.01	7.71
B-3DOWN-STREAM-ANA		50yr-1hr	0.61	124.08	126.00	0.0006	67040	0.59	31.93	0.61	31.62
B-3DOWN-STREAM-ANA		50yr-24hr	12.00	124.02	126.00	0.0002	65984	12.03	5.16	12.00	5.10
B-3DOWN-STREAM-ANA		50yr-2hr	0.82	124.07	126.00	0.0004	66904	0.80	28.22	0.82	27.56
B-3DOWN-STREAM-ANA		50yr-4hr	2.02	124.05	126.00	0.0002	66447	2.00	15.28	2.02	15.18
B-3DOWN-STREAM-ANA		50yr-8hr	4.00	124.05	126.00	0.0003	66528	4.00	17.32	4.00	17.21

DOWNSTREAM ANALYSIS-PRE-DEVELOPMENT-OUTPUT

Name	Group	Simulation	Max Time Stage hrs	Max Stage ft	Warning Stage ft	Max Delta Stage ft	Max Surf Area ft2	Max Time Inflow hrs	Max Inflow cfs	Max Time Outflow hrs	Max Outflow cfs
B-3DOWN-STREAM-ANA		5yr-1hr	0.63	124.06	126.00	0.0005	66619	0.60	20.02	0.63	19.59
B-3DOWN-STREAM-ANA		5yr-24hr	12.01	124.02	126.00	0.0001	65862	11.99	3.03	12.01	3.03
B-3DOWN-STREAM-ANA		5yr-2hr	0.83	124.05	126.00	0.0003	66533	0.80	17.89	0.83	17.35
B-3DOWN-STREAM-ANA		5yr-4hr	2.02	124.04	126.00	0.0001	66207	2.00	9.66	2.02	9.57
B-3DOWN-STREAM-ANA		5yr-8hr	4.00	124.04	126.00	0.0002	66263	4.00	10.88	4.00	10.80
BARINEAU-RDDOWN-STREAM-ANA		100yr-1hr	1.26	94.97	102.00	0.0032	19768	0.99	19.45	1.26	14.21
BARINEAU-RDDOWN-STREAM-ANA		100yr-24hr	16.32	96.63	102.00	0.0029	49261	16.13	56.26	16.32	55.92
BARINEAU-RDDOWN-STREAM-ANA		100yr-2hr	2.00	95.58	102.00	0.0031	33318	1.90	38.92	2.00	27.15
BARINEAU-RDDOWN-STREAM-ANA		100yr-4hr	3.80	96.84	102.00	0.0033	52836	3.43	78.38	3.80	62.31
BARINEAU-RDDOWN-STREAM-ANA		100yr-8hr	5.59	97.24	102.00	0.0039	81460	5.43	94.30	5.59	75.79
BARINEAU-RDDOWN-STREAM-ANA		10yr-1hr	1.26	94.64	102.00	-0.0036	14379	0.91	12.45	1.26	8.65
BARINEAU-RDDOWN-STREAM-ANA		10yr-24hr	19.68	95.49	102.00	-0.0022	31370	19.47	31.30	19.68	25.03
BARINEAU-RDDOWN-STREAM-ANA		10yr-2hr	1.47	94.69	102.00	0.0031	15188	1.02	11.57	1.47	9.41
BARINEAU-RDDOWN-STREAM-ANA		10yr-4hr	4.00	94.90	102.00	0.0022	18656	3.91	13.48	4.00	12.91
BARINEAU-RDDOWN-STREAM-ANA		10yr-8hr	6.50	95.41	102.00	0.0019	29786	5.73	30.83	6.50	23.31
BARINEAU-RDDOWN-STREAM-ANA		25yr-1hr	1.24	94.77	102.00	-0.0034	16582	0.86	15.06	1.24	10.78
BARINEAU-RDDOWN-STREAM-ANA		25yr-24hr	19.50	95.87	102.00	0.0019	37129	15.36	36.90	19.50	34.28
BARINEAU-RDDOWN-STREAM-ANA		25yr-2hr	1.46	94.81	102.00	0.0031	17277	1.18	14.29	1.46	11.49
BARINEAU-RDDOWN-STREAM-ANA		25yr-4hr	4.00	95.68	102.00	0.0030	35091	3.50	40.13	4.00	29.62
BARINEAU-RDDOWN-STREAM-ANA		25yr-8hr	5.78	96.34	102.00	0.0035	44601	5.14	54.40	5.78	47.15
BARINEAU-RDDOWN-STREAM-ANA		2yr-1hr	1.19	94.38	102.00	-0.0049	10006	1.03	6.96	1.19	5.15
BARINEAU-RDDOWN-STREAM-ANA		2yr-24hr	21.88	94.32	102.00	0.0006	8781	21.58	4.51	21.88	4.49
BARINEAU-RDDOWN-STREAM-ANA		2yr-2hr	1.53	94.43	102.00	0.0031	10957	1.20	7.33	1.53	5.77
BARINEAU-RDDOWN-STREAM-ANA		2yr-4hr	2.98	94.41	102.00	0.0019	10625	2.59	6.18	2.98	5.52
BARINEAU-RDDOWN-STREAM-ANA		2yr-8hr	4.42	94.44	102.00	0.0012	11205	4.26	6.43	4.42	5.96
BARINEAU-RDDOWN-STREAM-ANA		50yr-1hr	1.24	94.85	102.00	0.0033	17852	0.83	16.52	1.24	12.10
BARINEAU-RDDOWN-STREAM-ANA		50yr-24hr	19.38	96.20	102.00	0.0031	42102	19.19	43.65	19.38	43.12
BARINEAU-RDDOWN-STREAM-ANA		50yr-2hr	2.00	95.04	102.00	0.0030	21349	2.00	17.71	2.00	15.60
BARINEAU-RDDOWN-STREAM-ANA		50yr-4hr	4.00	96.19	102.00	0.0041	46053	3.45	51.12	4.00	42.87
BARINEAU-RDDOWN-STREAM-ANA		50yr-8hr	5.59	96.71	102.00	0.0036	50615	5.19	69.47	5.59	58.17
BARINEAU-RDDOWN-STREAM-ANA		5yr-1hr	1.27	94.52	102.00	-0.0050	12478	0.98	10.10	1.27	7.00
BARINEAU-RDDOWN-STREAM-ANA		5yr-24hr	19.77	95.05	102.00	-0.0009	20854	19.42	15.89	19.77	15.75
BARINEAU-RDDOWN-STREAM-ANA		5yr-2hr	1.50	94.57	102.00	0.0031	13345	1.10	9.85	1.50	7.73
BARINEAU-RDDOWN-STREAM-ANA		5yr-4hr	2.90	94.57	102.00	0.0021	13293	2.68	8.14	2.90	7.68
BARINEAU-RDDOWN-STREAM-ANA		5yr-8hr	7.52	94.98	102.00	0.0016	19849	7.28	14.68	7.52	14.51
BETHEL-CHURCH-DOWN-STREAM-ANA		100yr-1hr	1.80	142.05	155.00	0.0001	140570	0.87	5.35	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		100yr-24hr	24.00	143.77	155.00	0.0005	156788	12.03	7.71	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		100yr-2hr	2.00	142.22	155.00	0.0003	142182	1.27	8.37	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		100yr-4hr	4.00	142.54	155.00	0.0006	145259	3.00	17.59	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		100yr-8hr	8.00	143.05	155.00	0.0007	150001	4.03	24.82	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		10yr-1hr	0.00	142.00	155.00	0.0000	140135	0.00	0.00	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		10yr-24hr	24.00	142.64	155.00	0.0002	146132	15.03	2.85	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		10yr-2hr	2.00	142.02	155.00	0.0001	140300	1.83	1.21	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		10yr-4hr	4.00	142.11	155.00	0.0002	141150	3.03	4.79	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		10yr-8hr	8.00	142.31	155.00	0.0003	143098	5.00	5.58	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		25yr-1hr	1.80	142.00	155.00	0.0000	140177	0.90	0.56	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		25yr-24hr	24.00	142.93	155.00	0.0003	148907	15.03	4.15	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		25yr-2hr	2.00	142.06	155.00	0.0002	140742	1.63	3.13	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		25yr-4hr	4.00	142.25	155.00	0.0003	142510	3.03	9.53	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		25yr-8hr	8.00	142.60	155.00	0.0005	145798	4.07	12.69	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		2yr-1hr	0.00	142.00	155.00	0.0000	140135	0.00	0.00	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		2yr-24hr	24.00	142.08	155.00	0.0001	140844	19.03	0.53	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		2yr-2hr	0.00	142.00	155.00	0.0000	140135	0.00	0.00	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		2yr-4hr	4.00	142.00	155.00	0.0000	140138	4.00	0.04	0.00	0.00

DOWNSTREAM ANALYSIS-PRE-DEVELOPMENT-OUTPUT

Name	Group	Simulation	Max Time Stage hrs	Max Stage ft	Warning Stage ft	Max Delta Stage ft	Max Surf Area ft2	Max Time Inflow hrs	Max Inflow cfs	Max Time Outflow hrs	Max Outflow cfs
BETHEL-CHURCH-DOWN-STREAM-ANA		2yr-8hr	8.00	142.03	155.00	0.0001	140400	7.00	0.48	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		50yr-1hr	1.80	142.02	155.00	0.0001	140297	0.87	2.16	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		50yr-24hr	24.00	143.29	155.00	0.0004	152338	15.00	5.72	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		50yr-2hr	2.00	142.12	155.00	0.0002	141302	1.47	5.23	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		50yr-4hr	4.00	142.35	155.00	0.0004	143468	3.00	12.47	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		50yr-8hr	8.00	142.77	155.00	0.0007	147382	4.03	17.27	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		5yr-1hr	0.00	142.00	155.00	0.0000	140135	0.00	0.00	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		5yr-24hr	24.00	142.36	155.00	0.0002	143554	19.00	1.83	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		5yr-2hr	2.00	142.00	155.00	0.0000	140144	2.00	0.19	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		5yr-4hr	4.00	142.04	155.00	0.0001	140539	3.07	2.11	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		5yr-8hr	8.00	142.18	155.00	0.0002	141865	5.03	3.46	0.00	0.00
CONFLUENCEDOWN-STREAM-ANA		100yr-1hr	0.99	104.59	107.50	0.0020	27750	0.85	22.58	0.99	19.45
CONFLUENCEDOWN-STREAM-ANA		100yr-24hr	12.89	104.78	107.50	0.0009	48024	16.13	50.46	16.18	50.43
CONFLUENCEDOWN-STREAM-ANA		100yr-2hr	1.90	104.70	107.50	0.0014	37399	2.00	30.25	1.90	36.36
CONFLUENCEDOWN-STREAM-ANA		100yr-4hr	3.28	104.91	107.50	-0.0013	56751	3.34	62.84	3.44	71.16
CONFLUENCEDOWN-STREAM-ANA		100yr-8hr	4.31	104.94	107.50	-0.0026	49159	5.19	75.97	5.62	86.30
CONFLUENCEDOWN-STREAM-ANA		10yr-1hr	1.05	104.44	107.50	0.0019	21075	0.89	13.48	0.91	12.45
CONFLUENCEDOWN-STREAM-ANA		10yr-24hr	19.47	104.61	107.50	-0.0016	39330	19.22	23.64	19.47	29.50
CONFLUENCEDOWN-STREAM-ANA		10yr-2hr	1.21	104.45	107.50	0.0014	21359	1.04	12.89	1.02	11.57
CONFLUENCEDOWN-STREAM-ANA		10yr-4hr	3.92	104.48	107.50	0.0010	25922	3.77	13.20	3.92	13.09
CONFLUENCEDOWN-STREAM-ANA		10yr-8hr	5.70	104.63	107.50	-0.0016	33118	5.47	22.18	5.73	29.48
CONFLUENCEDOWN-STREAM-ANA		25yr-1hr	1.02	104.51	107.50	0.0020	23892	0.87	17.13	0.86	15.06
CONFLUENCEDOWN-STREAM-ANA		25yr-24hr	15.61	104.68	107.50	-0.0011	42614	19.18	31.63	15.36	34.45
CONFLUENCEDOWN-STREAM-ANA		25yr-2hr	1.18	104.50	107.50	0.0014	23789	1.02	15.98	1.18	14.29
CONFLUENCEDOWN-STREAM-ANA		25yr-4hr	3.50	104.71	107.50	-0.0014	37119	3.60	29.81	3.50	37.77
CONFLUENCEDOWN-STREAM-ANA		25yr-8hr	5.31	104.83	107.50	-0.0015	51062	5.29	44.44	5.55	49.92
CONFLUENCEDOWN-STREAM-ANA		2yr-1hr	1.03	104.31	107.50	-0.0029	15364	0.94	7.41	1.03	6.96
CONFLUENCEDOWN-STREAM-ANA		2yr-24hr	21.56	104.26	107.50	0.0003	15219	21.44	4.50	21.56	4.49
CONFLUENCEDOWN-STREAM-ANA		2yr-2hr	1.37	104.33	107.50	0.0013	16132	1.11	7.61	1.20	7.33
CONFLUENCEDOWN-STREAM-ANA		2yr-4hr	2.81	104.32	107.50	0.0009	15511	2.62	6.04	2.59	6.18
CONFLUENCEDOWN-STREAM-ANA		2yr-8hr	4.26	104.34	107.50	0.0007	16344	4.13	6.85	4.26	6.43
CONFLUENCEDOWN-STREAM-ANA		50yr-1hr	1.00	104.54	107.50	0.0017	25467	0.86	19.40	0.83	16.52
CONFLUENCEDOWN-STREAM-ANA		50yr-24hr	14.04	104.71	107.50	-0.0015	44539	19.15	39.41	19.25	39.52
CONFLUENCEDOWN-STREAM-ANA		50yr-2hr	1.16	104.55	107.50	0.0016	25770	1.00	18.65	1.16	16.83
CONFLUENCEDOWN-STREAM-ANA		50yr-4hr	3.63	104.81	107.50	-0.0014	49175	3.50	41.24	3.45	47.11
CONFLUENCEDOWN-STREAM-ANA		50yr-8hr	4.94	104.86	107.50	0.0009	53368	5.19	56.41	5.20	62.50
CONFLUENCEDOWN-STREAM-ANA		5yr-1hr	1.09	104.39	107.50	-0.0028	18582	0.91	10.68	0.98	10.10
CONFLUENCEDOWN-STREAM-ANA		5yr-24hr	19.46	104.52	107.50	0.0007	27794	19.32	15.01	19.46	14.97
CONFLUENCEDOWN-STREAM-ANA		5yr-2hr	1.26	104.40	107.50	0.0013	19158	1.07	10.42	1.10	9.85
CONFLUENCEDOWN-STREAM-ANA		5yr-4hr	2.68	104.38	107.50	0.0010	18233	2.59	8.24	2.68	8.14
CONFLUENCEDOWN-STREAM-ANA		5yr-8hr	7.33	104.50	107.50	0.0008	27044	7.22	14.08	7.33	14.03
D-3DOWN-STREAM-ANA		100yr-1hr	2.00	117.41	126.00	0.0035	73956	1.00	43.36	2.00	3.60
D-3DOWN-STREAM-ANA		100yr-24hr	21.31	120.79	126.00	0.0026	212263	12.17	38.83	21.31	19.02
D-3DOWN-STREAM-ANA		100yr-2hr	2.00	118.35	126.00	0.0039	112417	1.27	56.56	2.00	9.42
D-3DOWN-STREAM-ANA		100yr-4hr	4.00	119.79	126.00	0.0035	171333	3.07	83.52	4.00	15.80
D-3DOWN-STREAM-ANA		100yr-8hr	7.68	120.77	126.00	0.0039	211419	4.20	99.84	7.68	18.95
D-3DOWN-STREAM-ANA		10yr-1hr	2.00	115.89	126.00	0.0030	37465	1.07	10.41	2.00	0.00
D-3DOWN-STREAM-ANA		10yr-24hr	19.86	118.67	126.00	0.0027	125433	15.13	16.35	19.86	11.59
D-3DOWN-STREAM-ANA		10yr-2hr	2.00	116.64	126.00	0.0031	50728	1.70	18.00	2.00	0.74
D-3DOWN-STREAM-ANA		10yr-4hr	4.00	117.91	126.00	0.0032	94284	3.13	33.55	4.00	6.46
D-3DOWN-STREAM-ANA		10yr-8hr	7.39	118.64	126.00	0.0033	124117	4.27	38.00	7.39	11.37
D-3DOWN-STREAM-ANA		25yr-1hr	2.00	116.56	126.00	0.0031	49264	1.00	21.85	2.00	0.56
D-3DOWN-STREAM-ANA		25yr-24hr	19.90	119.18	126.00	0.0026	146374	12.20	21.65	20.07	14.44
D-3DOWN-STREAM-ANA		25yr-2hr	2.00	117.34	126.00	0.0032	70885	1.53	28.94	2.00	3.23

DOWNSTREAM ANALYSIS-PRE-DEVELOPMENT-OUTPUT

Name	Group	Simulation	Max Time Stage hrs	Max Stage ft	Warning Stage ft	Max Delta Stage ft	Max Surf Area ft2	Max Time Inflow hrs	Max Inflow cfs	Max Time Outflow hrs	Max Outflow cfs
D-3DOWN-STREAM-ANA		25yr-4hr	4.00	118.70	126.00	0.0035	126802	3.10	52.30	4.00	11.81
D-3DOWN-STREAM-ANA		25yr-8hr	7.48	119.58	126.00	0.0036	162533	4.20	63.24	7.48	15.07
D-3DOWN-STREAM-ANA		2yr-1hr	2.00	115.02	126.00	0.0002	22321	1.20	0.17	0.00	0.00
D-3DOWN-STREAM-ANA		2yr-24hr	22.05	117.31	126.00	0.0014	69795	19.07	4.91	22.05	3.11
D-3DOWN-STREAM-ANA		2yr-2hr	2.00	115.37	126.00	0.0019	28475	1.97	4.31	0.00	0.00
D-3DOWN-STREAM-ANA		2yr-4hr	4.00	116.16	126.00	0.0029	42299	3.20	9.19	4.00	0.07
D-3DOWN-STREAM-ANA		2yr-8hr	8.00	117.11	126.00	0.0028	61675	5.13	10.67	8.00	2.24
D-3DOWN-STREAM-ANA		50yr-1hr	2.00	116.95	126.00	0.0032	56066	1.00	30.37	2.00	1.61
D-3DOWN-STREAM-ANA		50yr-24hr	21.21	119.94	126.00	0.0023	177285	12.17	29.24	21.21	16.29
D-3DOWN-STREAM-ANA		50yr-2hr	2.00	117.83	126.00	0.0039	90847	1.37	40.35	2.00	5.94
D-3DOWN-STREAM-ANA		50yr-4hr	4.00	119.12	126.00	0.0038	143883	3.07	63.83	4.00	14.19
D-3DOWN-STREAM-ANA		50yr-8hr	7.55	120.06	126.00	0.0036	182456	4.20	77.32	7.55	16.71
D-3DOWN-STREAM-ANA		5yr-1hr	2.00	115.39	126.00	0.0028	28887	1.07	4.10	0.00	0.00
D-3DOWN-STREAM-ANA		5yr-24hr	21.14	118.16	126.00	0.0023	104370	15.13	11.34	21.14	8.08
D-3DOWN-STREAM-ANA		5yr-2hr	2.00	116.03	126.00	0.0030	40009	1.80	10.77	2.00	0.02
D-3DOWN-STREAM-ANA		5yr-4hr	4.00	117.31	126.00	0.0031	69548	3.13	22.57	4.00	3.08
D-3DOWN-STREAM-ANA		5yr-8hr	7.60	118.13	126.00	0.0032	103531	4.27	25.48	7.60	7.94
E-SITEDOWN-STREAM-ANA		100yr-1hr	0.60	126.46	131.00	0.0050	113	0.60	35.97	0.60	35.97
E-SITEDOWN-STREAM-ANA		100yr-24hr	12.00	126.21	131.00	0.0050	113	12.00	5.99	12.00	5.99
E-SITEDOWN-STREAM-ANA		100yr-2hr	0.80	126.44	131.00	-0.0134	113	0.80	32.16	0.80	32.15
E-SITEDOWN-STREAM-ANA		100yr-4hr	2.00	126.33	131.00	-0.0075	113	2.00	17.66	2.00	17.65
E-SITEDOWN-STREAM-ANA		100yr-8hr	4.00	126.34	131.00	0.0050	113	4.00	19.72	4.00	19.72
E-SITEDOWN-STREAM-ANA		10yr-1hr	0.60	126.38	131.00	0.0050	113	0.60	24.00	0.60	24.00
E-SITEDOWN-STREAM-ANA		10yr-24hr	11.99	126.18	131.00	0.0050	113	12.00	3.74	11.99	3.74
E-SITEDOWN-STREAM-ANA		10yr-2hr	0.80	126.36	131.00	0.0050	113	0.80	21.14	0.80	21.14
E-SITEDOWN-STREAM-ANA		10yr-4hr	2.00	126.27	131.00	0.0050	113	2.00	11.31	2.00	11.30
E-SITEDOWN-STREAM-ANA		10yr-8hr	4.00	126.28	131.00	-0.0050	113	4.00	12.64	4.00	12.64
E-SITEDOWN-STREAM-ANA		25yr-1hr	0.60	126.41	131.00	0.0050	113	0.60	28.97	0.60	28.94
E-SITEDOWN-STREAM-ANA		25yr-24hr	12.05	126.19	131.00	0.0050	113	12.00	4.39	12.05	4.46
E-SITEDOWN-STREAM-ANA		25yr-2hr	0.80	126.39	131.00	0.0050	113	0.80	25.00	0.80	25.00
E-SITEDOWN-STREAM-ANA		25yr-4hr	2.00	126.29	131.00	0.0050	113	2.00	13.84	2.00	13.84
E-SITEDOWN-STREAM-ANA		25yr-8hr	4.00	126.31	131.00	0.0050	113	4.00	15.74	4.00	15.74
E-SITEDOWN-STREAM-ANA		2yr-1hr	0.60	126.31	131.00	0.0050	113	0.60	15.16	0.60	15.16
E-SITEDOWN-STREAM-ANA		2yr-24hr	12.00	126.15	131.00	0.0050	113	12.00	2.02	12.00	2.02
E-SITEDOWN-STREAM-ANA		2yr-2hr	0.80	126.30	131.00	0.0050	113	0.80	14.11	0.80	14.10
E-SITEDOWN-STREAM-ANA		2yr-4hr	2.04	126.23	131.00	0.0050	113	2.00	7.21	2.04	7.27
E-SITEDOWN-STREAM-ANA		2yr-8hr	4.00	126.23	131.00	0.0050	113	4.00	7.76	4.00	7.76
E-SITEDOWN-STREAM-ANA		50yr-1hr	0.59	126.44	131.00	0.0050	113	0.60	31.96	0.59	31.93
E-SITEDOWN-STREAM-ANA		50yr-24hr	12.03	126.20	131.00	0.0050	113	12.00	5.11	12.03	5.16
E-SITEDOWN-STREAM-ANA		50yr-2hr	0.80	126.41	131.00	-0.0116	113	0.80	28.24	0.80	28.22
E-SITEDOWN-STREAM-ANA		50yr-4hr	2.00	126.31	131.00	0.0050	113	2.00	15.29	2.00	15.28
E-SITEDOWN-STREAM-ANA		50yr-8hr	4.00	126.32	131.00	0.0050	113	4.00	17.32	4.00	17.32
E-SITEDOWN-STREAM-ANA		5yr-1hr	0.60	126.35	131.00	0.0050	113	0.60	20.05	0.60	20.02
E-SITEDOWN-STREAM-ANA		5yr-24hr	11.99	126.17	131.00	0.0050	113	12.00	3.04	11.99	3.03
E-SITEDOWN-STREAM-ANA		5yr-2hr	0.80	126.33	131.00	0.0050	113	0.80	17.93	0.80	17.89
E-SITEDOWN-STREAM-ANA		5yr-4hr	2.00	126.25	131.00	0.0050	113	2.00	9.66	2.00	9.66
E-SITEDOWN-STREAM-ANA		5yr-8hr	4.00	126.27	131.00	0.0050	113	4.00	10.88	4.00	10.88
POA-BARINEAUDOWN-STREAM-ANA		100yr-1hr	0.00	92.00	95.00	0.0000	5	1.26	14.21	0.00	0.00
POA-BARINEAUDOWN-STREAM-ANA		100yr-24hr	0.00	92.00	95.00	0.0000	5	16.32	55.92	0.00	0.00
POA-BARINEAUDOWN-STREAM-ANA		100yr-2hr	0.00	92.00	95.00	0.0000	5	2.00	27.15	0.00	0.00
POA-BARINEAUDOWN-STREAM-ANA		100yr-4hr	0.00	92.00	95.00	0.0000	5	3.80	62.31	0.00	0.00
POA-BARINEAUDOWN-STREAM-ANA		100yr-8hr	0.00	92.00	95.00	0.0000	5	5.59	75.79	0.00	0.00
POA-BARINEAUDOWN-STREAM-ANA		10yr-1hr	0.00	92.00	95.00	0.0000	5	1.26	8.65	0.00	0.00
POA-BARINEAUDOWN-STREAM-ANA		10yr-24hr	0.00	92.00	95.00	0.0000	5	19.68	25.03	0.00	0.00

DOWNSTREAM ANALYSIS-PRE-DEVELOPMENT-OUTPUT

Name	Group	Simulation	Max Time Stage hrs	Max Stage ft	Warning Stage ft	Max Delta Stage ft	Max Surf Area ft2	Max Time Inflow hrs	Max Inflow cfs	Max Time Outflow hrs	Max Outflow cfs
POA-BARINEAUDOWN-STREAM-ANA		10yr-2hr	0.00	92.00	95.00	0.0000	5	1.47	9.41	0.00	0.00
POA-BARINEAUDOWN-STREAM-ANA		10yr-4hr	0.00	92.00	95.00	0.0000	5	4.00	12.91	0.00	0.00
POA-BARINEAUDOWN-STREAM-ANA		10yr-8hr	0.00	92.00	95.00	0.0000	5	6.50	23.31	0.00	0.00
POA-BARINEAUDOWN-STREAM-ANA		25yr-1hr	0.00	92.00	95.00	0.0000	5	1.24	10.78	0.00	0.00
POA-BARINEAUDOWN-STREAM-ANA		25yr-24hr	0.00	92.00	95.00	0.0000	5	19.50	34.28	0.00	0.00
POA-BARINEAUDOWN-STREAM-ANA		25yr-2hr	0.00	92.00	95.00	0.0000	5	1.46	11.49	0.00	0.00
POA-BARINEAUDOWN-STREAM-ANA		25yr-4hr	0.00	92.00	95.00	0.0000	5	4.00	29.62	0.00	0.00
POA-BARINEAUDOWN-STREAM-ANA		25yr-8hr	0.00	92.00	95.00	0.0000	5	5.78	47.15	0.00	0.00
POA-BARINEAUDOWN-STREAM-ANA		2yr-1hr	0.00	92.00	95.00	0.0000	5	1.19	5.15	0.00	0.00
POA-BARINEAUDOWN-STREAM-ANA		2yr-24hr	0.00	92.00	95.00	0.0000	5	21.88	4.49	0.00	0.00
POA-BARINEAUDOWN-STREAM-ANA		2yr-2hr	0.00	92.00	95.00	0.0000	5	1.53	5.77	0.00	0.00
POA-BARINEAUDOWN-STREAM-ANA		2yr-4hr	0.00	92.00	95.00	0.0000	5	2.98	5.52	0.00	0.00
POA-BARINEAUDOWN-STREAM-ANA		2yr-8hr	0.00	92.00	95.00	0.0000	5	4.42	5.96	0.00	0.00
POA-BARINEAUDOWN-STREAM-ANA		50yr-1hr	0.00	92.00	95.00	0.0000	5	1.24	12.10	0.00	0.00
POA-BARINEAUDOWN-STREAM-ANA		50yr-24hr	0.00	92.00	95.00	0.0000	5	19.38	43.12	0.00	0.00
POA-BARINEAUDOWN-STREAM-ANA		50yr-2hr	0.00	92.00	95.00	0.0000	5	2.00	15.60	0.00	0.00
POA-BARINEAUDOWN-STREAM-ANA		50yr-4hr	0.00	92.00	95.00	0.0000	5	4.00	42.87	0.00	0.00
POA-BARINEAUDOWN-STREAM-ANA		50yr-8hr	0.00	92.00	95.00	0.0000	5	5.59	58.17	0.00	0.00
POA-BARINEAUDOWN-STREAM-ANA		5yr-1hr	0.00	92.00	95.00	0.0000	5	1.27	7.00	0.00	0.00
POA-BARINEAUDOWN-STREAM-ANA		5yr-24hr	0.00	92.00	95.00	0.0000	5	19.77	15.75	0.00	0.00
POA-BARINEAUDOWN-STREAM-ANA		5yr-2hr	0.00	92.00	95.00	0.0000	5	1.50	7.73	0.00	0.00
POA-BARINEAUDOWN-STREAM-ANA		5yr-4hr	0.00	92.00	95.00	0.0000	5	2.90	7.68	0.00	0.00
POA-BARINEAUDOWN-STREAM-ANA		5yr-8hr	0.00	92.00	95.00	0.0000	5	7.52	14.51	0.00	0.00
RAILROAD-1DOWN-STREAM-ANA		100yr-1hr	2.00	115.18	125.00	0.0004	7255	2.00	3.60	2.00	3.56
RAILROAD-1DOWN-STREAM-ANA		100yr-24hr	21.37	115.40	125.00	0.0006	18078	21.31	19.02	21.37	19.02
RAILROAD-1DOWN-STREAM-ANA		100yr-2hr	2.00	115.26	125.00	0.0005	10630	2.00	9.42	2.00	9.16
RAILROAD-1DOWN-STREAM-ANA		100yr-4hr	4.00	115.36	125.00	0.0006	16449	4.00	15.80	4.00	15.72
RAILROAD-1DOWN-STREAM-ANA		100yr-8hr	7.74	115.40	125.00	0.0006	18046	7.68	18.95	7.74	18.95
RAILROAD-1DOWN-STREAM-ANA		10yr-1hr	2.00	115.00	125.00	0.0000	115	2.00	0.00	0.00	0.00
RAILROAD-1DOWN-STREAM-ANA		10yr-24hr	19.91	115.31	125.00	-0.0019	14159	19.86	11.59	19.91	11.59
RAILROAD-1DOWN-STREAM-ANA		10yr-2hr	2.00	115.09	125.00	0.0004	3583	2.00	0.74	2.00	0.59
RAILROAD-1DOWN-STREAM-ANA		10yr-4hr	4.00	115.23	125.00	0.0004	9174	4.00	6.46	4.00	6.38
RAILROAD-1DOWN-STREAM-ANA		10yr-8hr	7.45	115.31	125.00	0.0011	14026	7.39	11.37	7.45	11.37
RAILROAD-1DOWN-STREAM-ANA		25yr-1hr	2.00	115.08	125.00	0.0005	3437	2.00	0.56	2.00	0.53
RAILROAD-1DOWN-STREAM-ANA		25yr-24hr	20.12	115.35	125.00	0.0011	15777	20.07	14.44	20.12	14.43
RAILROAD-1DOWN-STREAM-ANA		25yr-2hr	2.00	115.17	125.00	0.0004	6771	2.00	3.23	2.00	2.99
RAILROAD-1DOWN-STREAM-ANA		25yr-4hr	4.00	115.31	125.00	0.0012	14200	4.00	11.81	4.00	11.66
RAILROAD-1DOWN-STREAM-ANA		25yr-8hr	7.54	115.35	125.00	0.0006	16110	7.48	15.07	7.54	15.07
RAILROAD-1DOWN-STREAM-ANA		2yr-1hr	0.00	115.00	125.00	0.0000	117	0.00	0.00	0.00	0.00
RAILROAD-1DOWN-STREAM-ANA		2yr-24hr	22.08	115.17	125.00	0.0002	6871	22.05	3.11	22.08	3.11
RAILROAD-1DOWN-STREAM-ANA		2yr-2hr	0.00	115.00	125.00	0.0000	117	0.00	0.00	0.00	0.00
RAILROAD-1DOWN-STREAM-ANA		2yr-4hr	4.00	115.03	125.00	0.0004	1352	4.00	0.07	4.00	0.04
RAILROAD-1DOWN-STREAM-ANA		2yr-8hr	8.00	115.15	125.00	0.0004	6012	8.00	2.24	8.00	2.22
RAILROAD-1DOWN-STREAM-ANA		50yr-1hr	2.00	115.13	125.00	0.0005	5240	2.00	1.61	2.00	1.57
RAILROAD-1DOWN-STREAM-ANA		50yr-24hr	21.26	115.37	125.00	0.0011	16740	21.21	16.29	21.26	16.29
RAILROAD-1DOWN-STREAM-ANA		50yr-2hr	2.00	115.22	125.00	0.0005	8755	2.00	5.94	2.00	5.68
RAILROAD-1DOWN-STREAM-ANA		50yr-4hr	4.00	115.34	125.00	0.0009	15594	4.00	14.19	4.00	14.10
RAILROAD-1DOWN-STREAM-ANA		50yr-8hr	7.61	115.37	125.00	0.0007	16953	7.55	16.71	7.61	16.71
RAILROAD-1DOWN-STREAM-ANA		5yr-1hr	0.00	115.00	125.00	0.0000	117	0.00	0.00	0.00	0.00
RAILROAD-1DOWN-STREAM-ANA		5yr-24hr	21.17	115.25	125.00	0.0003	10101	21.14	8.08	21.17	8.08
RAILROAD-1DOWN-STREAM-ANA		5yr-2hr	2.00	115.01	125.00	0.0002	461	2.00	0.02	2.00	0.00
RAILROAD-1DOWN-STREAM-ANA		5yr-4hr	4.00	115.17	125.00	0.0004	6764	4.00	3.08	4.00	2.99
RAILROAD-1DOWN-STREAM-ANA		5yr-8hr	7.63	115.25	125.00	0.0004	10030	7.60	7.94	7.63	7.94
TRANS RDDOWN-STREAM-ANA		100yr-1hr	0.85	110.19	112.00	0.0008	33707	0.80	23.09	0.85	22.58

DOWNSTREAM ANALYSIS-PRE-DEVELOPMENT-OUTPUT

Name	Group	Simulation	Max Time Stage hrs	Max Stage ft	Warning Stage ft	Max Delta Stage ft	Max Surf Area ft2	Max Time Inflow hrs	Max Inflow cfs	Max Time Outflow hrs	Max Outflow cfs
TRANS RDDOWN-STREAM-ANA		100yr-24hr	15.30	110.23	112.00	-0.0002	34026	15.27	30.44	15.30	30.43
TRANS RDDOWN-STREAM-ANA		100yr-2hr	1.00	110.19	112.00	0.0005	33604	0.94	22.59	1.00	22.15
TRANS RDDOWN-STREAM-ANA		100yr-4hr	3.29	110.28	112.00	0.0003	35840	3.23	44.22	3.29	44.13
TRANS RDDOWN-STREAM-ANA		100yr-8hr	5.17	110.31	112.00	0.0003	36984	5.14	53.70	5.17	53.64
TRANS RDDOWN-STREAM-ANA		10yr-1hr	0.89	110.14	112.00	0.0007	31921	0.83	13.94	0.89	13.48
TRANS RDDOWN-STREAM-ANA		10yr-24hr	19.19	110.12	112.00	-0.0002	30977	19.15	11.03	19.19	11.02
TRANS RDDOWN-STREAM-ANA		10yr-2hr	1.04	110.13	112.00	0.0005	31797	0.96	13.24	1.04	12.89
TRANS RDDOWN-STREAM-ANA		10yr-4hr	2.59	110.11	112.00	0.0002	31101	2.56	9.78	2.59	9.76
TRANS RDDOWN-STREAM-ANA		10yr-8hr	5.28	110.13	112.00	0.0002	31387	5.20	13.09	5.28	13.04
TRANS RDDOWN-STREAM-ANA		25yr-1hr	0.87	110.16	112.00	0.0008	32672	0.81	17.62	0.87	17.13
TRANS RDDOWN-STREAM-ANA		25yr-24hr	19.17	110.15	112.00	-0.0002	31769	19.13	15.53	19.17	15.52
TRANS RDDOWN-STREAM-ANA		25yr-2hr	1.02	110.15	112.00	0.0005	32440	0.95	16.39	1.02	15.98
TRANS RDDOWN-STREAM-ANA		25yr-4hr	3.34	110.17	112.00	0.0003	32447	3.29	19.32	3.34	19.28
TRANS RDDOWN-STREAM-ANA		25yr-8hr	5.23	110.22	112.00	0.0002	33750	5.18	28.35	5.23	28.28
TRANS RDDOWN-STREAM-ANA		2yr-1hr	0.94	110.09	112.00	-0.0008	30543	0.86	7.81	0.94	7.41
TRANS RDDOWN-STREAM-ANA		2yr-24hr	12.16	110.04	112.00	-0.0001	28970	12.09	1.91	12.16	1.89
TRANS RDDOWN-STREAM-ANA		2yr-2hr	1.11	110.10	112.00	0.0004	30594	1.02	7.85	1.11	7.61
TRANS RDDOWN-STREAM-ANA		2yr-4hr	2.62	110.08	112.00	0.0002	30199	2.57	6.08	2.62	6.04
TRANS RDDOWN-STREAM-ANA		2yr-8hr	4.13	110.09	112.00	0.0002	30405	4.07	6.95	4.13	6.85
TRANS RDDOWN-STREAM-ANA		50yr-1hr	0.86	110.17	112.00	0.0007	33115	0.80	19.90	0.86	19.40
TRANS RDDOWN-STREAM-ANA		50yr-24hr	15.39	110.18	112.00	-0.0002	32751	15.33	21.60	15.39	21.59
TRANS RDDOWN-STREAM-ANA		50yr-2hr	1.00	110.17	112.00	0.0006	32968	0.94	19.10	1.00	18.65
TRANS RDDOWN-STREAM-ANA		50yr-4hr	3.33	110.21	112.00	0.0003	33684	3.29	27.75	3.33	27.70
TRANS RDDOWN-STREAM-ANA		50yr-8hr	5.20	110.26	112.00	0.0002	35019	5.17	37.77	5.20	37.70
TRANS RDDOWN-STREAM-ANA		5yr-1hr	0.91	110.12	112.00	-0.0008	31313	0.84	11.13	0.91	10.68
TRANS RDDOWN-STREAM-ANA		5yr-24hr	19.25	110.09	112.00	-0.0001	30089	19.17	6.58	19.25	6.56
TRANS RDDOWN-STREAM-ANA		5yr-2hr	1.07	110.12	112.00	0.0004	31255	0.99	10.72	1.07	10.42
TRANS RDDOWN-STREAM-ANA		5yr-4hr	2.59	110.10	112.00	0.0002	30747	2.56	8.27	2.59	8.24
TRANS RDDOWN-STREAM-ANA		5yr-8hr	4.11	110.11	112.00	0.0002	31129	4.06	9.98	4.11	9.87

Downstream Analysis Post-Development Output

Name	Group	Simulation	Max Time Stage hrs	Max Stage ft	Warning Stage ft	Max Delta Stage ft	Max Surf Area ft2	Max Time Inflow hrs	Max Inflow cfs	Max Time Outflow hrs	Max Outflow cfs
B-2DOWN-STREAM-ANA		100yr-1hr	1.48	120.19	125.00	-0.0007	47607	1.05	7.13	1.48	4.80
B-2DOWN-STREAM-ANA		100yr-24hr	15.37	120.45	125.00	-0.0014	53211	15.17	19.08	15.37	18.92
B-2DOWN-STREAM-ANA		100yr-2hr	2.00	120.37	125.00	0.0004	51595	2.00	15.48	2.00	13.86
B-2DOWN-STREAM-ANA		100yr-4hr	3.36	120.60	125.00	-0.0008	56661	3.16	31.96	3.36	29.75
B-2DOWN-STREAM-ANA		100yr-8hr	5.20	120.66	125.00	0.0011	57958	5.09	35.25	5.20	34.61
B-2DOWN-STREAM-ANA		10yr-1hr	2.01	120.05	125.00	0.0002	44578	1.23	0.74	2.01	0.56
B-2DOWN-STREAM-ANA		10yr-24hr	19.27	120.24	125.00	-0.0008	48617	19.11	7.14	19.27	7.06
B-2DOWN-STREAM-ANA		10yr-2hr	2.00	120.12	125.00	0.0003	46218	1.96	3.54	2.00	2.47
B-2DOWN-STREAM-ANA		10yr-4hr	3.71	120.24	125.00	0.0004	48680	3.28	7.67	3.71	6.95
B-2DOWN-STREAM-ANA		10yr-8hr	5.41	120.31	125.00	-0.0026	50183	5.17	11.12	5.41	10.39
B-2DOWN-STREAM-ANA		25yr-1hr	1.74	120.10	125.00	0.0003	45644	1.12	2.77	1.74	1.75
B-2DOWN-STREAM-ANA		25yr-24hr	16.21	120.30	125.00	-0.0010	49911	15.27	10.00	16.21	9.95
B-2DOWN-STREAM-ANA		25yr-2hr	2.00	120.20	125.00	0.0004	47933	2.00	6.46	2.00	5.37
B-2DOWN-STREAM-ANA		25yr-4hr	3.68	120.38	125.00	-0.0016	51702	3.33	15.14	3.68	14.22
B-2DOWN-STREAM-ANA		25yr-8hr	5.41	120.47	125.00	-0.0028	53611	5.23	20.52	5.41	19.77
B-2DOWN-STREAM-ANA		2yr-1hr	2.00	120.04	125.00	0.0004	44431	1.37	0.59	2.00	0.44
B-2DOWN-STREAM-ANA		2yr-24hr	21.69	120.07	125.00	-0.0002	45178	21.22	1.25	21.69	1.20
B-2DOWN-STREAM-ANA		2yr-2hr	2.00	120.04	125.00	0.0002	44473	2.00	0.67	2.00	0.47
B-2DOWN-STREAM-ANA		2yr-4hr	4.00	120.06	125.00	0.0001	44860	3.97	1.01	4.00	0.83
B-2DOWN-STREAM-ANA		2yr-8hr	6.65	120.09	125.00	0.0002	45552	6.08	1.70	6.65	1.63
B-2DOWN-STREAM-ANA		50yr-1hr	1.59	120.13	125.00	-0.0003	46433	1.07	4.51	1.59	2.85
B-2DOWN-STREAM-ANA		50yr-24hr	15.45	120.37	125.00	-0.0019	51431	15.24	13.97	15.45	13.82
B-2DOWN-STREAM-ANA		50yr-2hr	2.00	120.28	125.00	0.0004	49642	2.00	10.38	2.00	8.97
B-2DOWN-STREAM-ANA		50yr-4hr	3.57	120.45	125.00	0.0005	53347	3.23	20.33	3.57	18.94
B-2DOWN-STREAM-ANA		50yr-8hr	5.29	120.54	125.00	-0.0010	55303	5.12	25.98	5.29	25.22
B-2DOWN-STREAM-ANA		5yr-1hr	2.00	120.04	125.00	0.0003	44513	1.38	0.66	2.00	0.51
B-2DOWN-STREAM-ANA		5yr-24hr	19.33	120.18	125.00	-0.0006	47332	19.17	4.56	19.33	4.49
B-2DOWN-STREAM-ANA		5yr-2hr	2.00	120.06	125.00	0.0002	44896	2.00	1.63	2.00	0.84
B-2DOWN-STREAM-ANA		5yr-4hr	3.83	120.15	125.00	0.0004	46907	3.24	4.18	3.83	3.60
B-2DOWN-STREAM-ANA		5yr-8hr	5.53	120.21	125.00	-0.0016	48184	5.20	6.52	5.53	5.96
B-3DOWN-STREAM-ANA		100yr-1hr	1.03	124.03	130.00	0.0001	66081	0.96	7.08	1.03	6.94
B-3DOWN-STREAM-ANA		100yr-24hr	12.12	124.03	130.00	0.0001	66066	12.07	6.66	12.12	6.64
B-3DOWN-STREAM-ANA		100yr-2hr	1.66	124.03	130.00	0.0001	66142	1.62	8.19	1.66	8.19
B-3DOWN-STREAM-ANA		100yr-4hr	3.04	124.05	130.00	0.0001	66386	3.02	13.72	3.04	13.68
B-3DOWN-STREAM-ANA		100yr-8hr	4.14	124.05	130.00	0.0001	66520	4.09	17.30	4.14	17.01
B-3DOWN-STREAM-ANA		10yr-1hr	1.23	124.01	130.00	0.0000	65687	1.11	0.75	1.23	0.74
B-3DOWN-STREAM-ANA		10yr-24hr	15.04	124.02	130.00	0.0001	65869	15.01	3.14	15.04	3.14
B-3DOWN-STREAM-ANA		10yr-2hr	1.96	124.02	130.00	0.0000	65894	1.89	3.56	1.96	3.54
B-3DOWN-STREAM-ANA		10yr-4hr	3.14	124.03	130.00	0.0001	66060	3.08	6.58	3.14	6.52
B-3DOWN-STREAM-ANA		10yr-8hr	5.04	124.03	130.00	0.0001	66074	5.01	6.82	5.04	6.81
B-3DOWN-STREAM-ANA		25yr-1hr	1.12	124.02	130.00	0.0001	65845	1.03	2.89	1.12	2.77
B-3DOWN-STREAM-ANA		25yr-24hr	13.07	124.02	130.00	0.0001	65927	13.03	4.09	13.07	4.09
B-3DOWN-STREAM-ANA		25yr-2hr	1.75	124.03	130.00	0.0001	66019	1.68	5.77	1.75	5.75
B-3DOWN-STREAM-ANA		25yr-4hr	3.13	124.03	130.00	0.0001	66137	3.08	8.10	3.13	8.09
B-3DOWN-STREAM-ANA		25yr-8hr	5.02	124.03	130.00	0.0001	66147	5.00	8.30	5.02	8.30
B-3DOWN-STREAM-ANA		2yr-1hr	1.37	124.01	130.00	0.0000	65672	1.10	0.59	1.37	0.59
B-3DOWN-STREAM-ANA		2yr-24hr	21.10	124.01	130.00	0.0000	65705	21.04	0.92	21.10	0.92
B-3DOWN-STREAM-ANA		2yr-2hr	2.00	124.01	130.00	0.0000	65681	2.00	0.68	2.00	0.67
B-3DOWN-STREAM-ANA		2yr-4hr	3.97	124.01	130.00	0.0000	65713	3.78	1.02	3.97	1.01
B-3DOWN-STREAM-ANA		2yr-8hr	6.08	124.01	130.00	0.0000	65770	6.04	1.70	6.08	1.70
B-3DOWN-STREAM-ANA		50yr-1hr	1.07	124.02	130.00	0.0001	65951	0.99	4.65	1.07	4.51
B-3DOWN-STREAM-ANA		50yr-24hr	12.18	124.02	130.00	0.0001	66000	12.11	5.40	12.18	5.38
B-3DOWN-STREAM-ANA		50yr-2hr	1.66	124.03	130.00	0.0001	66099	1.62	7.30	1.66	7.30
B-3DOWN-STREAM-ANA		50yr-4hr	3.11	124.04	130.00	0.0001	66207	3.06	9.66	3.11	9.57
B-3DOWN-STREAM-ANA		50yr-8hr	4.24	124.04	130.00	0.0001	66273	4.18	11.13	4.24	11.05

DOWNSTREAM ANALYSIS-POST

Name	Group	Simulation	Max Time Stage hrs	Max Stage ft	Warning Stage ft	Max Delta Stage ft	Max Surf Area ft2	Max Time Inflow hrs	Max Inflow cfs	Max Time Outflow hrs	Max Outflow cfs
B-3DOWN-STREAM-ANA		5yr-1hr	1.38	124.01	130.00	0.0000	65680	1.11	0.66	1.38	0.66
B-3DOWN-STREAM-ANA		5yr-24hr	15.19	124.01	130.00	0.0000	65820	15.10	2.40	15.19	2.40
B-3DOWN-STREAM-ANA		5yr-2hr	2.00	124.01	130.00	0.0000	65764	2.00	1.72	2.00	1.63
B-3DOWN-STREAM-ANA		5yr-4hr	3.24	124.02	130.00	0.0001	65932	3.15	4.21	3.24	4.17
B-3DOWN-STREAM-ANA		5yr-8hr	5.09	124.02	130.00	0.0001	65992	5.05	5.28	5.09	5.25
BARINEAU-RDDOWN-STREAM-ANA		100yr-1hr	2.00	94.53	102.00	0.0031	12928	1.97	7.87	2.00	7.07
BARINEAU-RDDOWN-STREAM-ANA		100yr-24hr	16.33	96.67	102.00	-0.0050	49810	15.46	57.22	16.33	56.89
BARINEAU-RDDOWN-STREAM-ANA		100yr-2hr	2.00	95.26	102.00	0.0031	26673	2.00	30.75	2.00	20.03
BARINEAU-RDDOWN-STREAM-ANA		100yr-4hr	3.90	96.90	102.00	0.0039	53998	3.52	82.01	3.90	64.21
BARINEAU-RDDOWN-STREAM-ANA		100yr-8hr	5.70	97.31	102.00	-0.0047	83692	5.54	96.02	5.70	78.18
BARINEAU-RDDOWN-STREAM-ANA		10yr-1hr	2.01	93.80	102.00	0.0022	2172	2.01	0.45	2.01	0.36
BARINEAU-RDDOWN-STREAM-ANA		10yr-24hr	19.82	95.52	102.00	-0.0049	31778	19.09	31.54	19.82	25.66
BARINEAU-RDDOWN-STREAM-ANA		10yr-2hr	2.00	93.97	102.00	0.0016	3872	2.00	2.05	2.00	1.25
BARINEAU-RDDOWN-STREAM-ANA		10yr-4hr	4.00	94.91	102.00	0.0030	19472	4.00	15.52	4.00	13.15
BARINEAU-RDDOWN-STREAM-ANA		10yr-8hr	6.49	95.51	102.00	0.0049	31679	5.73	33.99	6.49	25.42
BARINEAU-RDDOWN-STREAM-ANA		25yr-1hr	2.00	94.06	102.00	0.0030	4587	2.00	2.16	2.00	1.91
BARINEAU-RDDOWN-STREAM-ANA		25yr-24hr	19.53	95.89	102.00	0.0049	37447	15.18	36.65	19.53	34.75
BARINEAU-RDDOWN-STREAM-ANA		25yr-2hr	2.00	94.37	102.00	0.0025	11201	2.00	8.27	2.00	5.06
BARINEAU-RDDOWN-STREAM-ANA		25yr-4hr	4.00	95.74	102.00	0.0041	36524	3.70	44.03	4.00	30.86
BARINEAU-RDDOWN-STREAM-ANA		25yr-8hr	5.88	96.42	102.00	0.0042	46068	5.31	58.62	5.88	49.59
BARINEAU-RDDOWN-STREAM-ANA		2yr-1hr	2.00	93.77	102.00	0.0036	1935	2.00	0.32	2.00	0.23
BARINEAU-RDDOWN-STREAM-ANA		2yr-24hr	22.27	94.35	102.00	0.0016	9174	22.07	4.78	22.27	4.77
BARINEAU-RDDOWN-STREAM-ANA		2yr-2hr	2.00	93.76	102.00	0.0012	1928	2.00	0.32	2.00	0.22
BARINEAU-RDDOWN-STREAM-ANA		2yr-4hr	4.00	93.87	102.00	0.0007	2605	4.00	0.74	4.00	0.67
BARINEAU-RDDOWN-STREAM-ANA		2yr-8hr	8.00	94.25	102.00	0.0015	7660	8.00	3.78	8.00	3.72
BARINEAU-RDDOWN-STREAM-ANA		50yr-1hr	2.00	94.26	102.00	0.0031	7898	2.00	4.15	2.00	3.74
BARINEAU-RDDOWN-STREAM-ANA		50yr-24hr	19.41	96.22	102.00	-0.0050	42384	15.51	44.01	19.41	43.58
BARINEAU-RDDOWN-STREAM-ANA		50yr-2hr	2.00	94.74	102.00	0.0029	17839	2.00	16.46	2.00	10.24
BARINEAU-RDDOWN-STREAM-ANA		50yr-4hr	4.00	96.21	102.00	0.0044	47793	3.69	56.07	4.00	43.35
BARINEAU-RDDOWN-STREAM-ANA		50yr-8hr	5.71	96.78	102.00	0.0041	51876	5.26	72.79	5.71	60.33
BARINEAU-RDDOWN-STREAM-ANA		5yr-1hr	2.00	93.78	102.00	0.0031	2066	2.00	0.39	2.00	0.30
BARINEAU-RDDOWN-STREAM-ANA		5yr-24hr	19.85	95.08	102.00	0.0030	21303	19.50	16.38	19.85	16.27
BARINEAU-RDDOWN-STREAM-ANA		5yr-2hr	2.00	93.79	102.00	0.0007	2204	2.00	0.47	2.00	0.32
BARINEAU-RDDOWN-STREAM-ANA		5yr-4hr	4.00	94.39	102.00	0.0024	10754	3.90	6.46	4.00	5.33
BARINEAU-RDDOWN-STREAM-ANA		5yr-8hr	7.44	95.05	102.00	0.0030	20966	7.21	15.89	7.44	15.78
BETHEL-CHURCH-DOWN-STREAM-ANA		100yr-1hr	1.81	142.05	155.00	0.0001	140570	0.87	5.35	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		100yr-24hr	24.00	143.77	155.00	0.0026	156789	12.03	7.71	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		100yr-2hr	2.00	142.22	155.00	0.0003	142182	1.27	8.37	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		100yr-4hr	4.00	142.54	155.00	0.0005	145260	3.00	17.59	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		100yr-8hr	8.00	143.05	155.00	0.0011	150001	4.03	24.82	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		10yr-1hr	0.00	142.00	155.00	0.0000	140135	0.00	0.00	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		10yr-24hr	24.00	142.64	155.00	0.0012	146131	15.03	2.85	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		10yr-2hr	2.00	142.02	155.00	0.0001	140300	1.83	1.21	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		10yr-4hr	4.00	142.11	155.00	0.0002	141150	3.03	4.79	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		10yr-8hr	8.00	142.31	155.00	0.0010	143095	5.00	5.58	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		25yr-1hr	1.80	142.00	155.00	0.0000	140177	0.90	0.56	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		25yr-24hr	23.99	142.93	155.00	0.0016	148906	15.03	4.15	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		25yr-2hr	2.00	142.06	155.00	0.0002	140742	1.63	3.13	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		25yr-4hr	4.00	142.25	155.00	0.0003	142510	3.03	9.53	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		25yr-8hr	8.00	142.60	155.00	0.0012	145794	4.07	12.69	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		2yr-1hr	0.00	142.00	155.00	0.0000	140135	0.00	0.00	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		2yr-24hr	24.00	142.08	155.00	0.0002	140844	19.02	0.53	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		2yr-2hr	0.00	142.00	155.00	0.0000	140135	0.00	0.00	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		2yr-4hr	4.00	142.00	155.00	0.0000	140138	4.00	0.04	0.00	0.00

DOWNSTREAM ANALYSIS-POST

Name	Group	Simulation	Max Time Stage hrs	Max Stage ft	Warning Stage ft	Max Delta Stage ft	Max Surf Area ft2	Max Time Inflow hrs	Max Inflow cfs	Max Time Outflow hrs	Max Outflow cfs
BETHEL-CHURCH-DOWN-STREAM-ANA		2yr-8hr	8.00	142.03	155.00	0.0001	140400	7.01	0.48	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		50yr-1hr	1.80	142.02	155.00	0.0001	140297	0.87	2.16	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		50yr-24hr	24.01	143.29	155.00	0.0020	152338	15.01	5.72	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		50yr-2hr	2.00	142.12	155.00	0.0002	141302	1.47	5.23	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		50yr-4hr	4.00	142.35	155.00	0.0004	143467	3.00	12.47	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		50yr-8hr	8.00	142.77	155.00	0.0012	147381	4.03	17.27	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		5yr-1hr	0.00	142.00	155.00	0.0000	140135	0.00	0.00	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		5yr-24hr	24.00	142.36	155.00	0.0008	143554	19.00	1.83	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		5yr-2hr	2.00	142.00	155.00	0.0000	140144	2.00	0.19	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		5yr-4hr	4.00	142.04	155.00	0.0001	140539	3.07	2.11	0.00	0.00
BETHEL-CHURCH-DOWN-STREAM-ANA		5yr-8hr	8.01	142.18	155.00	0.0007	141865	5.03	3.46	0.00	0.00
CONFLUENCEDOWN-STREAM-ANA		100yr-1hr	1.97	104.37	107.50	0.0015	20377	1.71	8.15	1.97	7.87
CONFLUENCEDOWN-STREAM-ANA		100yr-24hr	12.90	104.80	107.50	0.0024	48937	15.41	51.44	15.51	51.42
CONFLUENCEDOWN-STREAM-ANA		100yr-2hr	2.00	104.71	107.50	0.0014	36884	2.00	31.37	2.00	28.13
CONFLUENCEDOWN-STREAM-ANA		100yr-4hr	3.14	104.95	107.50	-0.0018	55361	3.38	66.50	3.53	75.16
CONFLUENCEDOWN-STREAM-ANA		100yr-8hr	4.50	105.01	107.50	-0.0049	58101	5.24	79.03	5.71	88.39
CONFLUENCEDOWN-STREAM-ANA		10yr-1hr	2.01	104.10	107.50	0.0007	5890	2.01	0.51	2.01	0.45
CONFLUENCEDOWN-STREAM-ANA		10yr-24hr	19.41	104.62	107.50	-0.0050	39712	19.28	24.12	19.09	29.58
CONFLUENCEDOWN-STREAM-ANA		10yr-2hr	2.00	104.19	107.50	0.0006	10910	2.00	2.74	2.00	2.05
CONFLUENCEDOWN-STREAM-ANA		10yr-4hr	4.00	104.52	107.50	0.0016	27640	3.95	15.41	4.00	15.14
CONFLUENCEDOWN-STREAM-ANA		10yr-8hr	5.73	104.66	107.50	-0.0048	34790	5.59	24.83	5.73	32.64
CONFLUENCEDOWN-STREAM-ANA		25yr-1hr	2.00	104.19	107.50	0.0009	10990	2.00	2.23	2.00	2.16
CONFLUENCEDOWN-STREAM-ANA		25yr-24hr	15.56	104.69	107.50	-0.0030	43086	19.21	32.10	15.18	34.20
CONFLUENCEDOWN-STREAM-ANA		25yr-2hr	2.00	104.33	107.50	0.0007	18721	2.00	9.39	2.00	8.18
CONFLUENCEDOWN-STREAM-ANA		25yr-4hr	3.70	104.75	107.50	-0.0018	40297	3.76	32.96	3.70	41.81
CONFLUENCEDOWN-STREAM-ANA		25yr-8hr	5.39	104.84	107.50	-0.0026	52095	5.39	47.36	5.31	54.05
CONFLUENCEDOWN-STREAM-ANA		2yr-1hr	2.00	104.09	107.50	0.0019	5318	2.00	0.39	2.00	0.32
CONFLUENCEDOWN-STREAM-ANA		2yr-24hr	21.99	104.27	107.50	0.0006	15501	21.85	4.75	21.99	4.74
CONFLUENCEDOWN-STREAM-ANA		2yr-2hr	2.00	104.09	107.50	0.0007	5309	2.00	0.40	2.00	0.32
CONFLUENCEDOWN-STREAM-ANA		2yr-4hr	4.00	104.13	107.50	0.0003	7295	4.00	0.82	4.00	0.74
CONFLUENCEDOWN-STREAM-ANA		2yr-8hr	8.00	104.24	107.50	0.0005	14117	7.99	3.80	8.00	3.78
CONFLUENCEDOWN-STREAM-ANA		50yr-1hr	2.00	104.25	107.50	0.0009	14298	1.94	4.19	2.00	4.15
CONFLUENCEDOWN-STREAM-ANA		50yr-24hr	13.93	104.72	107.50	0.0026	44875	19.19	39.87	15.51	40.11
CONFLUENCEDOWN-STREAM-ANA		50yr-2hr	2.00	104.53	107.50	0.0016	27909	2.00	18.36	2.00	15.55
CONFLUENCEDOWN-STREAM-ANA		50yr-4hr	3.43	104.84	107.50	-0.0021	49401	3.62	44.12	3.69	52.48
CONFLUENCEDOWN-STREAM-ANA		50yr-8hr	4.72	104.88	107.50	0.0017	51493	5.27	58.93	5.27	66.10
CONFLUENCEDOWN-STREAM-ANA		5yr-1hr	2.00	104.10	107.50	0.0013	5634	2.00	0.45	2.00	0.39
CONFLUENCEDOWN-STREAM-ANA		5yr-24hr	19.53	104.52	107.50	0.0026	28191	19.40	15.50	19.53	15.47
CONFLUENCEDOWN-STREAM-ANA		5yr-2hr	2.00	104.11	107.50	0.0004	6109	2.00	0.64	2.00	0.47
CONFLUENCEDOWN-STREAM-ANA		5yr-4hr	4.00	104.33	107.50	0.0019	18250	4.00	7.06	3.90	6.46
CONFLUENCEDOWN-STREAM-ANA		5yr-8hr	7.29	104.52	107.50	0.0015	27993	7.19	15.25	7.29	15.22
D-3DOWN-STREAM-ANA		100yr-1hr	2.00	117.41	126.00	0.0035	73915	1.00	43.36	2.00	3.60
D-3DOWN-STREAM-ANA		100yr-24hr	21.31	120.79	126.00	0.0050	212282	12.17	38.83	21.31	19.02
D-3DOWN-STREAM-ANA		100yr-2hr	2.00	118.35	126.00	0.0039	112439	1.27	56.56	2.00	9.42
D-3DOWN-STREAM-ANA		100yr-4hr	4.00	119.79	126.00	0.0050	171354	3.07	83.52	4.00	15.81
D-3DOWN-STREAM-ANA		100yr-8hr	7.68	120.77	126.00	0.0050	211426	4.20	99.83	7.68	18.95
D-3DOWN-STREAM-ANA		10yr-1hr	2.01	115.89	126.00	0.0030	37467	1.07	10.41	2.01	0.00
D-3DOWN-STREAM-ANA		10yr-24hr	19.85	118.67	126.00	0.0050	125445	15.13	16.35	19.85	11.59
D-3DOWN-STREAM-ANA		10yr-2hr	2.00	116.64	126.00	0.0031	50722	1.70	18.00	2.00	0.74
D-3DOWN-STREAM-ANA		10yr-4hr	4.00	117.91	126.00	0.0042	94294	3.13	33.55	4.00	6.46
D-3DOWN-STREAM-ANA		10yr-8hr	7.38	118.64	126.00	0.0050	124125	4.27	38.00	7.38	11.37
D-3DOWN-STREAM-ANA		25yr-1hr	2.00	116.56	126.00	0.0034	49246	1.00	21.85	2.00	0.56
D-3DOWN-STREAM-ANA		25yr-24hr	19.91	119.18	126.00	0.0050	146390	12.20	21.65	19.91	14.44
D-3DOWN-STREAM-ANA		25yr-2hr	2.00	117.34	126.00	0.0037	70901	1.53	28.94	2.00	3.23

Name	Group	Simulation	Max Time Stage hrs	Max Stage ft	Warning Stage ft	Max Delta Stage ft	Max Surf Area ft2	Max Time Inflow hrs	Max Inflow cfs	Max Time Outflow hrs	Max Outflow cfs
D-3DOWN-STREAM-ANA		25yr-4hr	4.00	118.70	126.00	0.0050	126762	3.10	52.30	4.00	11.80
D-3DOWN-STREAM-ANA		25yr-8hr	7.48	119.58	126.00	0.0050	162539	4.20	63.24	7.48	15.07
D-3DOWN-STREAM-ANA		2yr-1hr	2.00	115.02	126.00	0.0003	22321	1.20	0.17	0.00	0.00
D-3DOWN-STREAM-ANA		2yr-24hr	22.04	117.31	126.00	0.0043	69809	19.07	4.91	22.04	3.11
D-3DOWN-STREAM-ANA		2yr-2hr	2.00	115.37	126.00	0.0030	28463	1.97	4.31	0.00	0.00
D-3DOWN-STREAM-ANA		2yr-4hr	4.00	116.16	126.00	0.0036	42309	3.20	9.18	4.00	0.07
D-3DOWN-STREAM-ANA		2yr-8hr	7.99	117.11	126.00	0.0034	61643	5.13	10.67	7.99	2.23
D-3DOWN-STREAM-ANA		50yr-1hr	2.00	116.95	126.00	0.0035	56053	1.00	30.36	2.00	1.61
D-3DOWN-STREAM-ANA		50yr-24hr	21.21	119.94	126.00	0.0050	177303	12.17	29.24	21.21	16.29
D-3DOWN-STREAM-ANA		50yr-2hr	2.00	117.83	126.00	0.0039	90841	1.37	40.35	2.00	5.93
D-3DOWN-STREAM-ANA		50yr-4hr	4.00	119.12	126.00	0.0047	143877	3.07	63.83	4.00	14.19
D-3DOWN-STREAM-ANA		50yr-8hr	7.55	120.06	126.00	0.0050	182462	4.20	77.32	7.55	16.71
D-3DOWN-STREAM-ANA		5yr-1hr	2.00	115.39	126.00	0.0030	28890	1.07	4.10	0.00	0.00
D-3DOWN-STREAM-ANA		5yr-24hr	21.13	118.16	126.00	0.0050	104381	15.13	11.34	21.13	8.08
D-3DOWN-STREAM-ANA		5yr-2hr	2.00	116.03	126.00	0.0031	40020	1.80	10.77	2.00	0.02
D-3DOWN-STREAM-ANA		5yr-4hr	4.00	117.31	126.00	0.0041	69542	3.13	22.57	4.00	3.08
D-3DOWN-STREAM-ANA		5yr-8hr	7.59	118.14	126.00	0.0050	103541	4.27	25.48	7.59	7.94
E-SWMFDOWN-STREAM-ANA		100yr-1hr	0.96	129.38	131.00	0.0050	32472	0.53	57.83	0.96	7.08
E-SWMFDOWN-STREAM-ANA		100yr-24hr	12.07	129.33	131.00	0.0050	32279	12.00	7.65	12.07	6.66
E-SWMFDOWN-STREAM-ANA		100yr-2hr	1.62	129.71	131.00	0.0050	33889	0.80	48.57	1.62	8.19
E-SWMFDOWN-STREAM-ANA		100yr-4hr	3.02	130.02	131.00	0.0050	35199	2.00	25.91	3.02	13.72
E-SWMFDOWN-STREAM-ANA		100yr-8hr	4.09	130.12	131.00	0.0050	35644	4.00	26.27	4.09	17.30
E-SWMFDOWN-STREAM-ANA		10yr-1hr	1.11	128.61	131.00	0.0050	29118	0.53	39.81	1.11	0.75
E-SWMFDOWN-STREAM-ANA		10yr-24hr	15.01	128.99	131.00	0.0050	30827	12.00	5.20	15.01	3.14
E-SWMFDOWN-STREAM-ANA		10yr-2hr	1.89	129.03	131.00	0.0050	31025	0.80	33.34	1.89	3.56
E-SWMFDOWN-STREAM-ANA		10yr-4hr	3.08	129.32	131.00	0.0050	32248	2.00	17.55	3.08	6.58
E-SWMFDOWN-STREAM-ANA		10yr-8hr	5.01	129.35	131.00	0.0050	32345	4.00	18.08	5.01	6.82
E-SWMFDOWN-STREAM-ANA		25yr-1hr	1.03	128.96	131.00	0.0050	30700	0.53	47.33	1.03	2.89
E-SWMFDOWN-STREAM-ANA		25yr-24hr	13.03	129.09	131.00	0.0050	31258	12.00	5.92	13.03	4.09
E-SWMFDOWN-STREAM-ANA		25yr-2hr	1.68	129.25	131.00	0.0050	31936	0.80	38.73	1.68	5.77
E-SWMFDOWN-STREAM-ANA		25yr-4hr	3.08	129.66	131.00	0.0050	33671	2.00	20.98	3.08	8.10
E-SWMFDOWN-STREAM-ANA		25yr-8hr	5.00	129.76	131.00	0.0050	34087	4.00	21.73	5.00	8.30
E-SWMFDOWN-STREAM-ANA		2yr-1hr	1.10	127.82	131.00	0.0050	25595	0.60	26.44	1.10	0.59
E-SWMFDOWN-STREAM-ANA		2yr-24hr	21.04	128.66	131.00	0.0050	29356	11.99	3.15	21.04	0.92
E-SWMFDOWN-STREAM-ANA		2yr-2hr	2.00	128.35	131.00	0.0050	27985	0.80	23.36	2.00	0.68
E-SWMFDOWN-STREAM-ANA		2yr-4hr	3.78	128.68	131.00	0.0050	29455	2.00	11.77	3.78	1.02
E-SWMFDOWN-STREAM-ANA		2yr-8hr	6.04	128.80	131.00	0.0050	30004	4.00	11.96	6.04	1.70
E-SWMFDOWN-STREAM-ANA		50yr-1hr	0.99	129.14	131.00	0.0050	31493	0.53	51.84	0.99	4.65
E-SWMFDOWN-STREAM-ANA		50yr-24hr	12.11	129.21	131.00	0.0050	31790	12.00	6.72	12.11	5.40
E-SWMFDOWN-STREAM-ANA		50yr-2hr	1.62	129.43	131.00	0.0050	32693	0.80	43.21	1.62	7.30
E-SWMFDOWN-STREAM-ANA		50yr-4hr	3.06	129.86	131.00	0.0050	34514	2.00	22.88	3.06	9.66
E-SWMFDOWN-STREAM-ANA		50yr-8hr	4.18	129.93	131.00	0.0050	34803	4.00	23.55	4.18	11.13
E-SWMFDOWN-STREAM-ANA		5yr-1hr	1.11	128.27	131.00	0.0050	27588	0.53	33.79	1.11	0.66
E-SWMFDOWN-STREAM-ANA		5yr-24hr	15.10	128.90	131.00	0.0050	30434	12.00	4.40	15.10	2.40
E-SWMFDOWN-STREAM-ANA		5yr-2hr	2.00	128.81	131.00	0.0050	30016	0.80	28.83	2.00	1.72
E-SWMFDOWN-STREAM-ANA		5yr-4hr	3.15	129.10	131.00	0.0050	31309	2.00	15.25	3.15	4.21
E-SWMFDOWN-STREAM-ANA		5yr-8hr	5.05	129.20	131.00	0.0050	31742	4.00	15.95	5.05	5.28
POA-BARINEAUDOWN-STREAM-ANA		100yr-1hr	0.00	92.00	95.00	0.0000	5	2.00	7.07	0.00	0.00
POA-BARINEAUDOWN-STREAM-ANA		100yr-24hr	0.00	92.00	95.00	0.0000	5	16.33	56.89	0.00	0.00
POA-BARINEAUDOWN-STREAM-ANA		100yr-2hr	0.00	92.00	95.00	0.0000	5	2.00	20.03	0.00	0.00
POA-BARINEAUDOWN-STREAM-ANA		100yr-4hr	0.00	92.00	95.00	0.0000	5	3.90	64.21	0.00	0.00
POA-BARINEAUDOWN-STREAM-ANA		100yr-8hr	0.00	92.00	95.00	0.0000	5	5.70	78.18	0.00	0.00
POA-BARINEAUDOWN-STREAM-ANA		10yr-1hr	0.00	92.00	95.00	0.0000	5	2.01	0.36	0.00	0.00
POA-BARINEAUDOWN-STREAM-ANA		10yr-24hr	0.00	92.00	95.00	0.0000	5	19.82	25.66	0.00	0.00

Name	Group	Simulation	Max Time Stage hrs	Max Stage ft	Warning Stage ft	Max Delta Stage ft	Max Surf Area ft2	Max Time Inflow hrs	Max Inflow cfs	Max Time Outflow hrs	Max Outflow cfs
POA-BARINEAUDOWN-STREAM-ANA		10yr-2hr	0.00	92.00	95.00	0.0000	5	2.00	1.25	0.00	0.00
POA-BARINEAUDOWN-STREAM-ANA		10yr-4hr	0.00	92.00	95.00	0.0000	5	4.00	13.15	0.00	0.00
POA-BARINEAUDOWN-STREAM-ANA		10yr-8hr	0.00	92.00	95.00	0.0000	5	6.49	25.42	0.00	0.00
POA-BARINEAUDOWN-STREAM-ANA		25yr-1hr	0.00	92.00	95.00	0.0000	5	2.00	1.91	0.00	0.00
POA-BARINEAUDOWN-STREAM-ANA		25yr-24hr	0.00	92.00	95.00	0.0000	5	19.53	34.75	0.00	0.00
POA-BARINEAUDOWN-STREAM-ANA		25yr-2hr	0.00	92.00	95.00	0.0000	5	2.00	5.06	0.00	0.00
POA-BARINEAUDOWN-STREAM-ANA		25yr-4hr	0.00	92.00	95.00	0.0000	5	4.00	30.86	0.00	0.00
POA-BARINEAUDOWN-STREAM-ANA		25yr-8hr	0.00	92.00	95.00	0.0000	5	5.88	49.59	0.00	0.00
POA-BARINEAUDOWN-STREAM-ANA		2yr-1hr	0.00	92.00	95.00	0.0000	5	2.00	0.23	0.00	0.00
POA-BARINEAUDOWN-STREAM-ANA		2yr-24hr	0.00	92.00	95.00	0.0000	5	22.27	4.77	0.00	0.00
POA-BARINEAUDOWN-STREAM-ANA		2yr-2hr	0.00	92.00	95.00	0.0000	5	2.00	0.22	0.00	0.00
POA-BARINEAUDOWN-STREAM-ANA		2yr-4hr	0.00	92.00	95.00	0.0000	5	4.00	0.67	0.00	0.00
POA-BARINEAUDOWN-STREAM-ANA		2yr-8hr	0.00	92.00	95.00	0.0000	5	8.00	3.72	0.00	0.00
POA-BARINEAUDOWN-STREAM-ANA		50yr-1hr	0.00	92.00	95.00	0.0000	5	2.00	3.74	0.00	0.00
POA-BARINEAUDOWN-STREAM-ANA		50yr-24hr	0.00	92.00	95.00	0.0000	5	19.41	43.58	0.00	0.00
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POA-BARINEAUDOWN-STREAM-ANA		50yr-4hr	0.00	92.00	95.00	0.0000	5	4.00	43.35	0.00	0.00
POA-BARINEAUDOWN-STREAM-ANA		50yr-8hr	0.00	92.00	95.00	0.0000	5	5.71	60.33	0.00	0.00
POA-BARINEAUDOWN-STREAM-ANA		5yr-1hr	0.00	92.00	95.00	0.0000	5	2.00	0.30	0.00	0.00
POA-BARINEAUDOWN-STREAM-ANA		5yr-24hr	0.00	92.00	95.00	0.0000	5	19.85	16.27	0.00	0.00
POA-BARINEAUDOWN-STREAM-ANA		5yr-2hr	0.00	92.00	95.00	0.0000	5	2.00	0.32	0.00	0.00
POA-BARINEAUDOWN-STREAM-ANA		5yr-4hr	0.00	92.00	95.00	0.0000	5	4.00	5.33	0.00	0.00
POA-BARINEAUDOWN-STREAM-ANA		5yr-8hr	0.00	92.00	95.00	0.0000	5	7.44	15.78	0.00	0.00
RAILROAD-1DOWN-STREAM-ANA		100yr-1hr	2.00	115.18	125.00	0.0004	7257	2.00	3.60	2.00	3.56
RAILROAD-1DOWN-STREAM-ANA		100yr-24hr	21.36	115.40	125.00	0.0010	18079	21.31	19.02	21.36	19.02
RAILROAD-1DOWN-STREAM-ANA		100yr-2hr	2.00	115.26	125.00	0.0005	10627	2.00	9.42	2.00	9.15
RAILROAD-1DOWN-STREAM-ANA		100yr-4hr	4.00	115.36	125.00	0.0006	16449	4.00	15.81	4.00	15.72
RAILROAD-1DOWN-STREAM-ANA		100yr-8hr	7.74	115.40	125.00	0.0006	18046	7.68	18.95	7.74	18.95
RAILROAD-1DOWN-STREAM-ANA		10yr-1hr	2.01	115.00	125.00	0.0000	115	2.01	0.00	0.00	0.00
RAILROAD-1DOWN-STREAM-ANA		10yr-24hr	19.90	115.31	125.00	-0.0047	14160	19.85	11.59	19.90	11.59
RAILROAD-1DOWN-STREAM-ANA		10yr-2hr	2.00	115.09	125.00	0.0004	3582	2.00	0.74	2.00	0.59
RAILROAD-1DOWN-STREAM-ANA		10yr-4hr	4.00	115.23	125.00	0.0005	9172	4.00	6.46	4.00	6.37
RAILROAD-1DOWN-STREAM-ANA		10yr-8hr	7.45	115.31	125.00	0.0044	14027	7.38	11.37	7.45	11.37
RAILROAD-1DOWN-STREAM-ANA		25yr-1hr	2.00	115.08	125.00	0.0005	3432	2.00	0.56	2.00	0.53
RAILROAD-1DOWN-STREAM-ANA		25yr-24hr	19.96	115.35	125.00	0.0034	15778	19.91	14.44	19.96	14.44
RAILROAD-1DOWN-STREAM-ANA		25yr-2hr	2.00	115.17	125.00	0.0004	6773	2.00	3.23	2.00	3.00
RAILROAD-1DOWN-STREAM-ANA		25yr-4hr	4.00	115.31	125.00	0.0009	14204	4.00	11.80	4.00	11.66
RAILROAD-1DOWN-STREAM-ANA		25yr-8hr	7.53	115.35	125.00	0.0008	16110	7.48	15.07	7.53	15.07
RAILROAD-1DOWN-STREAM-ANA		2yr-1hr	0.00	115.00	125.00	0.0000	117	0.00	0.00	0.00	0.00
RAILROAD-1DOWN-STREAM-ANA		2yr-24hr	22.09	115.17	125.00	0.0007	6872	22.04	3.11	22.09	3.11
RAILROAD-1DOWN-STREAM-ANA		2yr-2hr	0.00	115.00	125.00	0.0000	117	0.00	0.00	0.00	0.00
RAILROAD-1DOWN-STREAM-ANA		2yr-4hr	4.00	115.03	125.00	0.0005	1356	4.00	0.07	4.00	0.04
RAILROAD-1DOWN-STREAM-ANA		2yr-8hr	8.00	115.15	125.00	0.0005	6015	7.99	2.23	8.00	2.22
RAILROAD-1DOWN-STREAM-ANA		50yr-1hr	2.00	115.13	125.00	0.0005	5240	2.00	1.61	2.00	1.57
RAILROAD-1DOWN-STREAM-ANA		50yr-24hr	21.26	115.37	125.00	0.0023	16741	21.21	16.29	21.26	16.29
RAILROAD-1DOWN-STREAM-ANA		50yr-2hr	2.00	115.22	125.00	0.0005	8755	2.00	5.93	2.00	5.68
RAILROAD-1DOWN-STREAM-ANA		50yr-4hr	4.00	115.34	125.00	0.0008	15593	4.00	14.19	4.00	14.09
RAILROAD-1DOWN-STREAM-ANA		50yr-8hr	7.61	115.37	125.00	0.0007	16953	7.55	16.71	7.61	16.71
RAILROAD-1DOWN-STREAM-ANA		5yr-1hr	0.00	115.00	125.00	0.0000	117	0.00	0.00	0.00	0.00
RAILROAD-1DOWN-STREAM-ANA		5yr-24hr	21.17	115.25	125.00	0.0007	10102	21.13	8.08	21.17	8.08
RAILROAD-1DOWN-STREAM-ANA		5yr-2hr	2.00	115.01	125.00	0.0003	463	2.00	0.02	2.00	0.00
RAILROAD-1DOWN-STREAM-ANA		5yr-4hr	4.00	115.17	125.00	0.0005	6764	4.00	3.08	4.00	2.99
RAILROAD-1DOWN-STREAM-ANA		5yr-8hr	7.62	115.25	125.00	0.0005	10031	7.59	7.94	7.62	7.94
TRANS RDDOWN-STREAM-ANA		100yr-1hr	1.52	110.08	112.00	-0.0004	29963	1.43	5.44	1.52	5.36

DOWNSTREAM ANALYSIS-POST

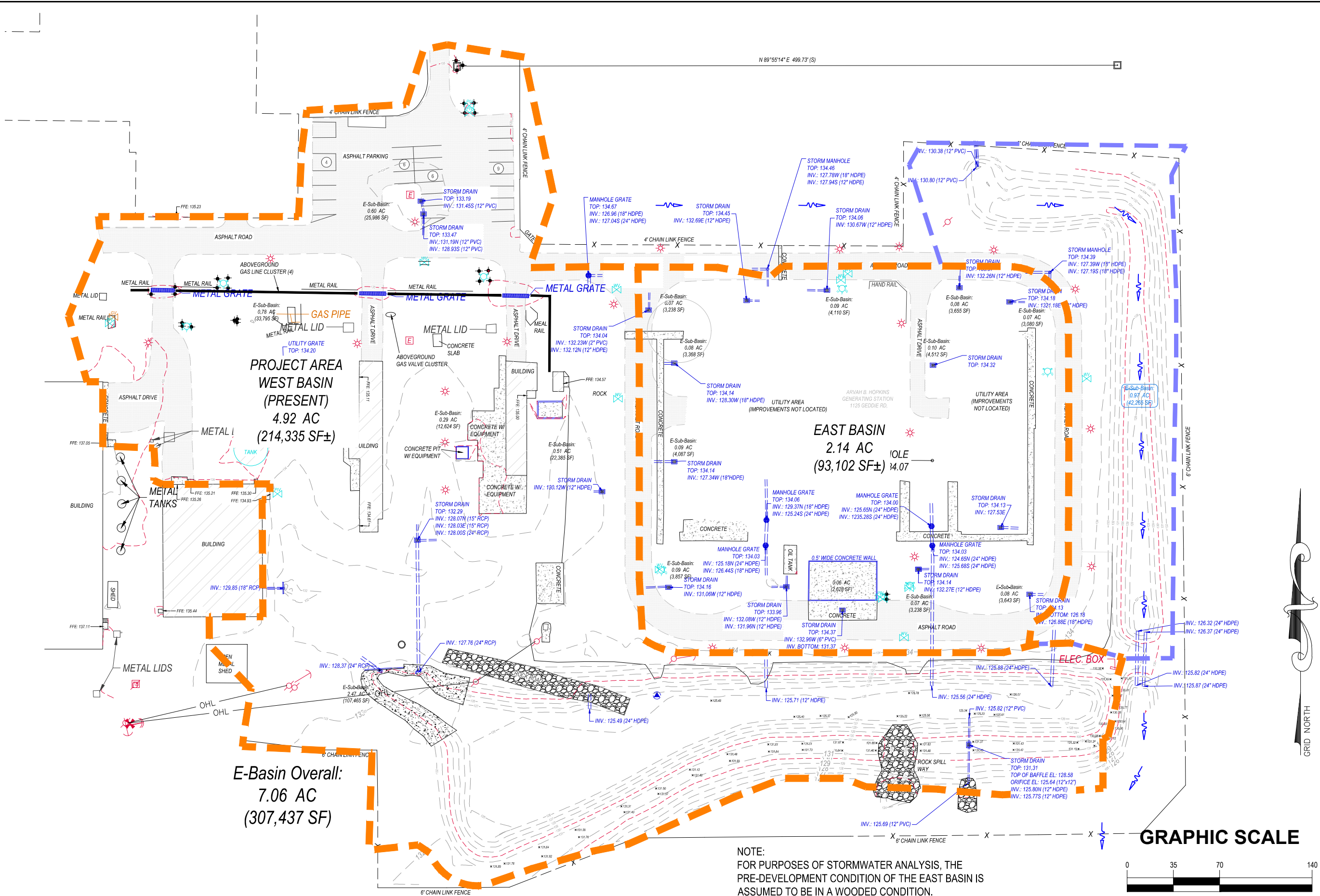
Name	Group	Simulation	Max Time Stage hrs	Max Stage ft	Warning Stage ft	Max Delta Stage ft	Max Surf Area ft2	Max Time Inflow hrs	Max Inflow cfs	Max Time Outflow hrs	Max Outflow cfs
TRANS RDDOWN-STREAM-ANA		100yr-24hr	15.36	110.23	112.00	-0.0008	34205	15.33	31.45	15.36	31.43
TRANS RDDOWN-STREAM-ANA		100yr-2hr	2.00	110.18	112.00	0.0002	32758	2.00	21.18	2.00	20.72
TRANS RDDOWN-STREAM-ANA		100yr-4hr	3.36	110.29	112.00	-0.0004	36411	3.33	47.74	3.36	47.61
TRANS RDDOWN-STREAM-ANA		100yr-8hr	5.23	110.32	112.00	0.0005	37447	5.19	56.67	5.23	56.62
TRANS RDDOWN-STREAM-ANA		10yr-1hr	2.01	110.02	112.00	0.0001	28408	2.01	0.56	2.01	0.51
TRANS RDDOWN-STREAM-ANA		10yr-24hr	19.26	110.12	112.00	-0.0005	31085	19.21	11.50	19.26	11.49
TRANS RDDOWN-STREAM-ANA		10yr-2hr	2.00	110.04	112.00	0.0001	29092	2.00	2.51	2.00	2.14
TRANS RDDOWN-STREAM-ANA		10yr-4hr	3.77	110.11	112.00	0.0002	30766	3.70	9.25	3.77	9.22
TRANS RDDOWN-STREAM-ANA		10yr-8hr	5.42	110.15	112.00	-0.0031	31836	5.36	15.18	5.42	15.13
TRANS RDDOWN-STREAM-ANA		25yr-1hr	1.88	110.04	112.00	0.0002	28909	1.74	1.75	1.88	1.72
TRANS RDDOWN-STREAM-ANA		25yr-24hr	16.24	110.15	112.00	-0.0006	31902	16.19	16.05	16.24	16.05
TRANS RDDOWN-STREAM-ANA		25yr-2hr	2.00	110.09	112.00	0.0002	30185	2.00	6.81	2.00	6.35
TRANS RDDOWN-STREAM-ANA		25yr-4hr	3.62	110.18	112.00	-0.0019	32817	3.57	21.05	3.62	21.02
TRANS RDDOWN-STREAM-ANA		25yr-8hr	5.36	110.23	112.00	-0.0032	34229	5.33	30.94	5.36	30.87
TRANS RDDOWN-STREAM-ANA		2yr-1hr	2.00	110.01	112.00	0.0002	28340	2.00	0.44	2.00	0.39
TRANS RDDOWN-STREAM-ANA		2yr-24hr	21.57	110.04	112.00	-0.0003	28831	21.42	1.64	21.57	1.64
TRANS RDDOWN-STREAM-ANA		2yr-2hr	2.00	110.01	112.00	0.0001	28350	2.00	0.47	2.00	0.40
TRANS RDDOWN-STREAM-ANA		2yr-4hr	4.00	110.02	112.00	0.0000	28534	4.00	0.83	4.00	0.78
TRANS RDDOWN-STREAM-ANA		2yr-8hr	7.33	110.04	112.00	-0.0002	28883	7.24	1.68	7.33	1.68
TRANS RDDOWN-STREAM-ANA		50yr-1hr	1.71	110.05	112.00	0.0002	29281	1.58	2.87	1.71	2.82
TRANS RDDOWN-STREAM-ANA		50yr-24hr	15.44	110.19	112.00	-0.0024	32941	15.40	22.59	15.44	22.58
TRANS RDDOWN-STREAM-ANA		50yr-2hr	2.00	110.13	112.00	-0.0003	31349	2.00	12.67	2.00	12.17
TRANS RDDOWN-STREAM-ANA		50yr-4hr	3.50	110.22	112.00	0.0004	34025	3.45	29.44	3.50	29.40
TRANS RDDOWN-STREAM-ANA		50yr-8hr	5.29	110.27	112.00	-0.0005	35490	5.25	40.54	5.29	40.48
TRANS RDDOWN-STREAM-ANA		5yr-1hr	2.00	110.02	112.00	0.0002	28377	2.00	0.51	2.00	0.45
TRANS RDDOWN-STREAM-ANA		5yr-24hr	19.33	110.09	112.00	-0.0003	30210	19.27	7.04	19.33	7.03
TRANS RDDOWN-STREAM-ANA		5yr-2hr	2.00	110.02	112.00	0.0001	28488	2.00	0.84	2.00	0.64
TRANS RDDOWN-STREAM-ANA		5yr-4hr	3.94	110.06	112.00	0.0002	29614	3.84	4.11	3.94	4.09
TRANS RDDOWN-STREAM-ANA		5yr-8hr	5.58	110.10	112.00	-0.0020	30493	5.50	8.00	5.58	7.97

7. Project Maps and Details

- 1.0) Survey of Project Area
- 2.0) Existing Conditions On-Site Basin Map
- 2.1) Post-Development On-Site Basin Map
- 3.0) Overall Drainage Basin Map
- 4.0) Required Modification to SWMF
- 4.1) Required Modification to SWMF

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25 YEARS

CONSULTING

ATLANTA

PROJECT NAME

HOPKINS ELECTRIC PLANT RICE PROJECT

CLIENT NAME

Sargent & Lundy, LLC

REVISIONS	DATE	FILE #	CONTRACT #	DRAWN BY
	03/28/17	16-304	R83.001	JM

ARCHIVE

DATE

FILE #

CONTRACT #

DRAWN BY

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SEAL

SHEET TITLE

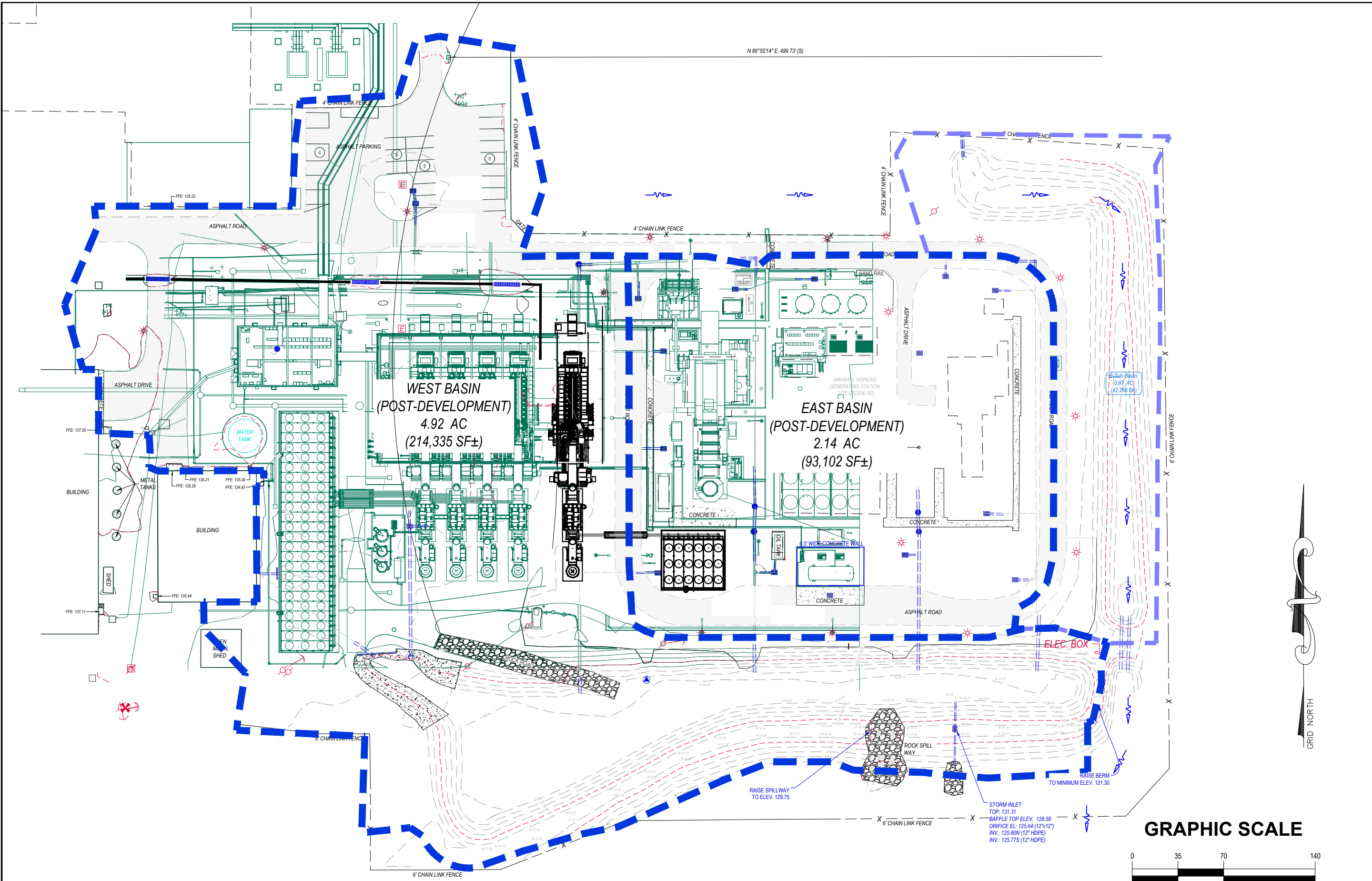
EXISTING CONDITIONS ON-SITE BASIN MAP

SHEET

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PROJECT NAME

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CLIENT NAME

Sargent & Lundy, LLC

REVISIONS

MB

R83.001-EMP-HOPKINS

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DATE 04/05/17

FILE # 16-304

CONTRACT # R83.001

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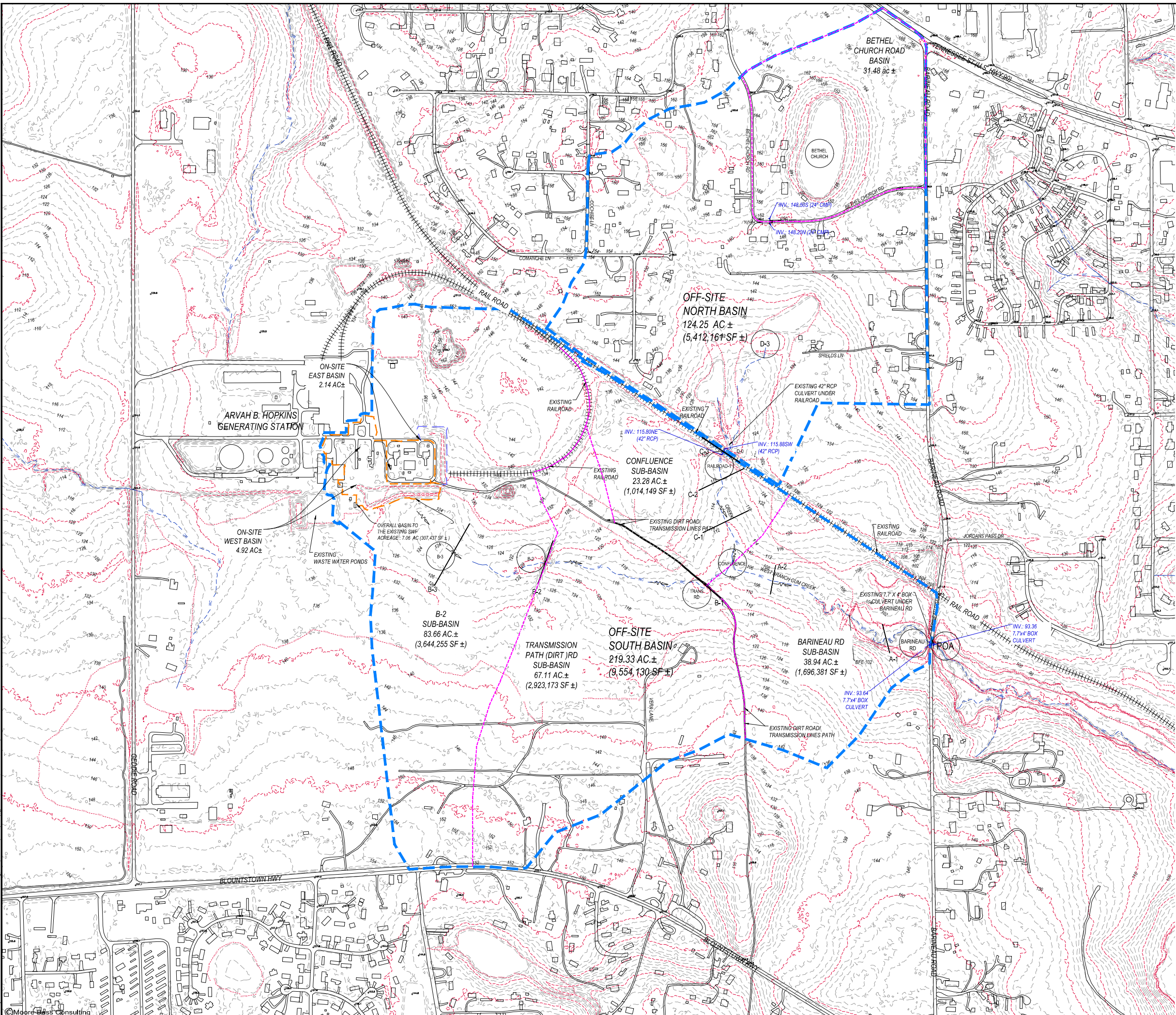
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POST DEVELOPMENT ON-SITE BASIN MAP

SHEET

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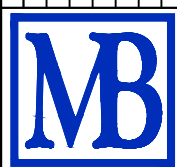
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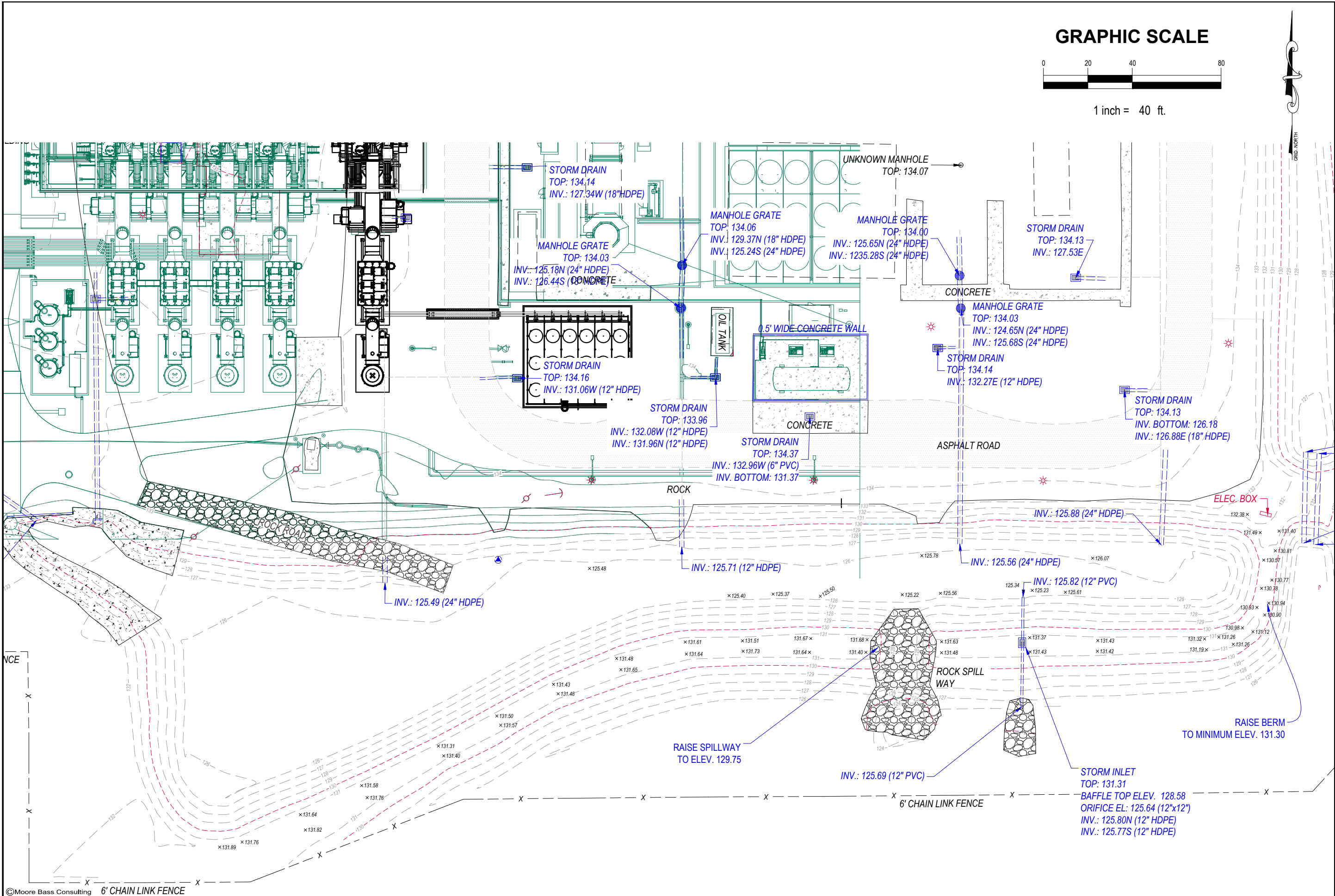
LEGEND

	DRAINAGE BASIN LINES
	SUB-BASIN LINES (OFF-SITE)
	ON-SITE BASINS
	LINK-NODE

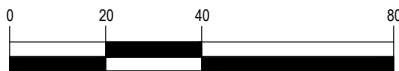
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GRAPHIC SCALE



1 inch = 40 ft.



25th

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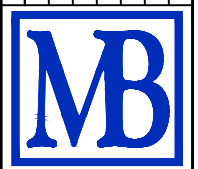
CONSULTING

ATLANTA

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PROJECT NAME	HOPKINS ELECTRIC PLANT RICE PROJECT
CLIENT NAME	Sargent & Lundy, LLC

REVISIONS	

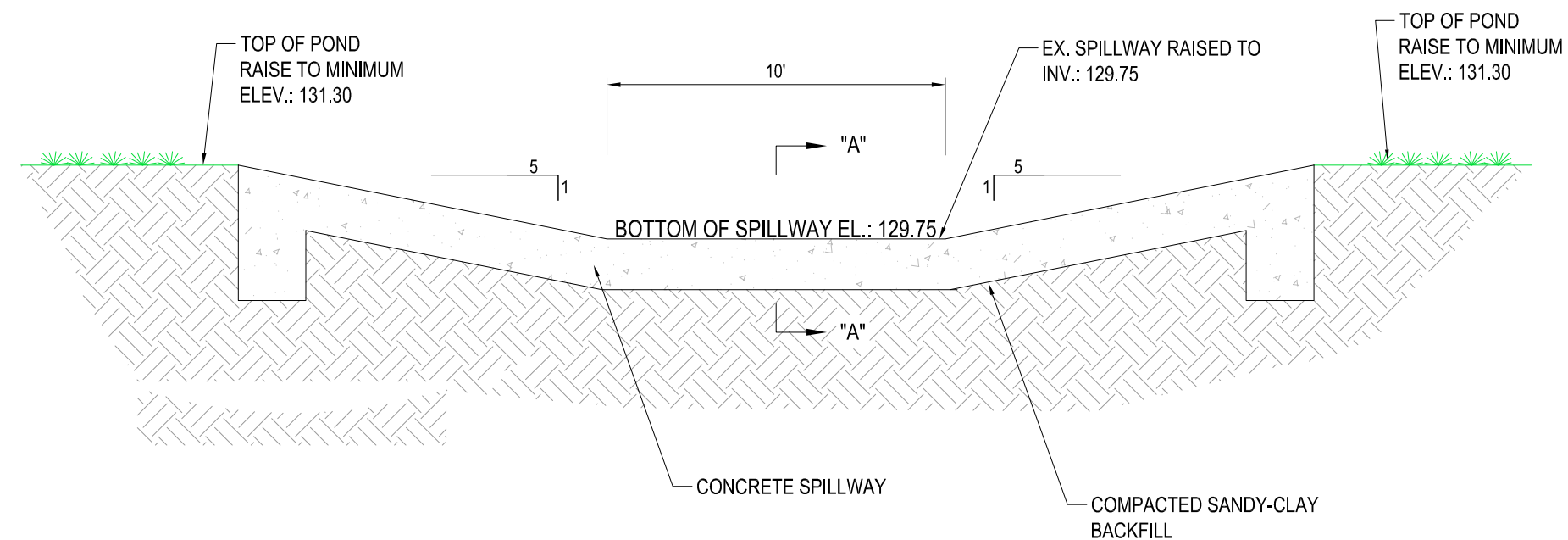
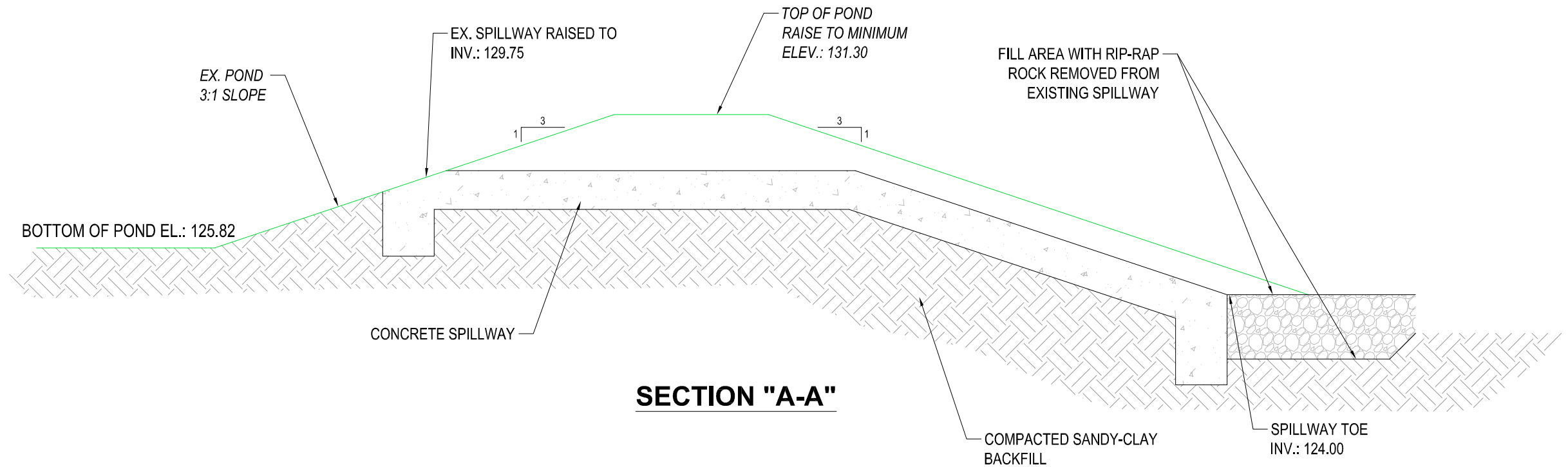


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DATE	03/28/17
FILE #	16-304
CONTRACT #	R83.001
DRAWN BY	JM

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SEAL

SHEET TITLE	REQUIRED MODIFICATION TO SWMF
SHEET	4.0



SCHEMATIC DETAIL FOR MODIFICATION TO EMERGENCY SPILLWAY

SCALE: 1" = 5'

Appendix C

Noise Sources

Appendix C. City of Tallahassee, A. B. Hopkins Plant, Wartsila Model W18V50SG Noise Sources and Noise Controls (Sound Reduction Equipment)

Equipment ID		Noise Source Type	Levels at Octave Band Centre Frequencies									dBA *	dB *
	Quantity		31.5	63	125	250	500	1000	2000	4000	8000		
Gas Combustion Turbine and Generator:													
Wartsil Engine	5	Lw	117	123	121	122	124	123	125	125	119	130.9	132.3
Wartsila Engine Exhaust	5	Lw	143	140	133	129	123	122	131	135	0	137.8	145.7
Wartsila Charge Air Intake	5	Lw	118	115	108	103	111	125	134	135	135	140.0	139.7
Generator Vent Intake	5	Lw	100	95	96	87	85	80	78	72	66	87.3	102.6
Insulated Exhaust Duct (per meter)	5	Lw	63	71	70	76	85	91	79	79	66	92.1	92.6
Auxillary Ventilation Intake	5	Lw	95	97	91	87	88	82	87	91	88	95.2	101.2
Roof Vent (per meter)	1	Lw	91	99	95	100	93	81	75	76	72	94.3	103.9
Low Noise 3-fan Cooling Radiator	30	Lw	0	102	102	103	100	94	90	87	78	101.0	108.2
Sound Reduciton Indices:													
Steel Sandwich Panel Wall	SteelPanel		8	14	20	26	32	36	30	48	50	33.0	
Exhaust Silencer 35 dBA	Exhst_Silencer		16	21	28	28	32	41	42	38	12	38.0	
Charge air silcencer 45 dBA	InletSilencer		2	3	9	24	40	40	50	51	41	33.0	

* As calculated in CADNA noise model.
Source: Wartsila as Delivered Equipment Sound Power Levels and Sound Attenuation, 2018



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